1931, No. 3 October 30

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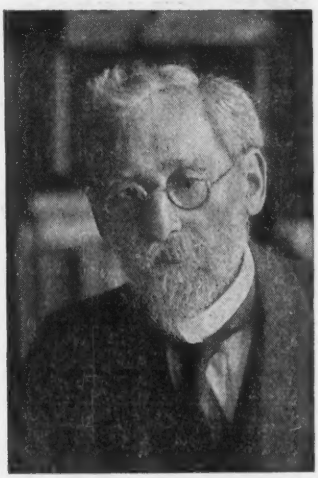

THE LEONHARD STEJNEGER ANNIVERSARY NUMBER

Published By
The American Society of Ichthyologists
And Herpetologists

CONTENTS

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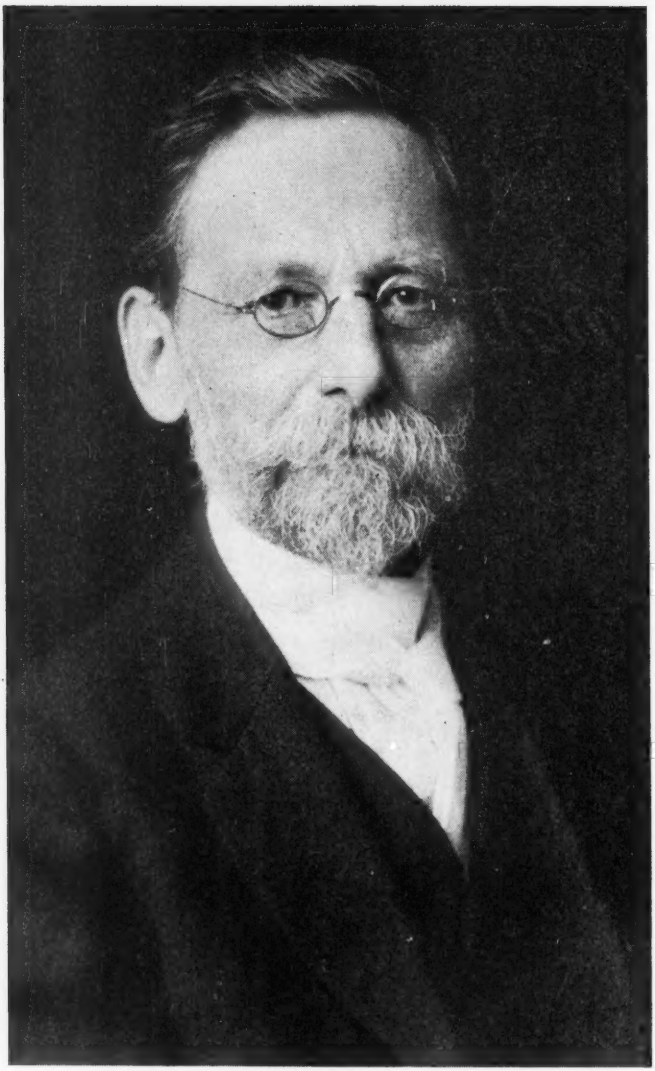


Leonhard Stejneger, to whom this number of Copeia is dedicated.

To Leonhard Stejneger

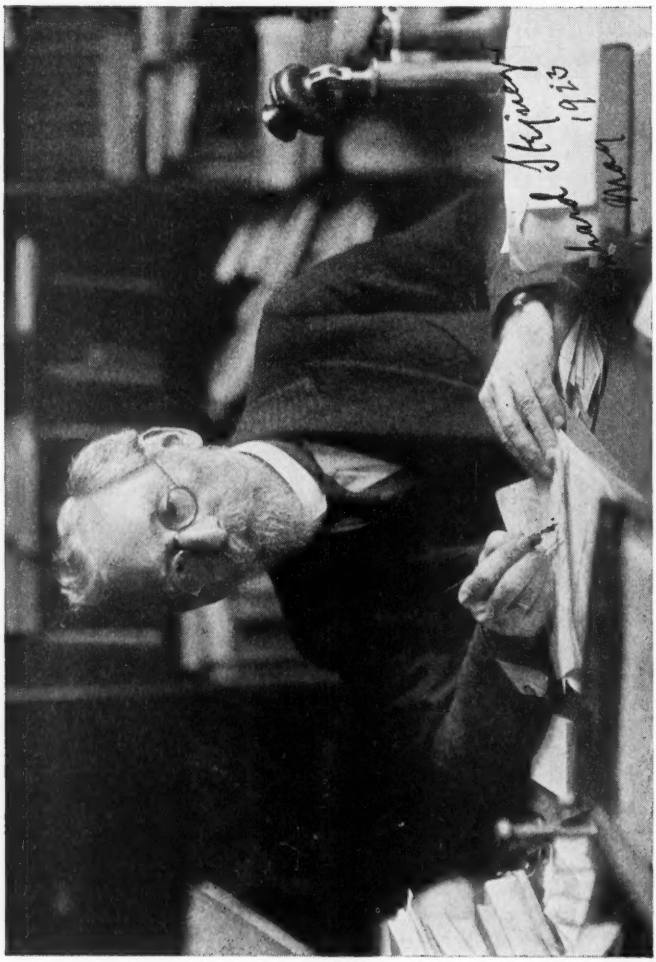
"DON'T ever hesitate to be inconsistent. Consider every case on its individual merits. To incline towards being consistent is to show signs of a closing mind." These are something very like the remarks, but by no means the only remarks, which Stejneger addressed to a certain youngster of sixteen years who planned a Monograph of the African Chamaeleons and who went to Washington to see the National Collection. There is no need to say that the monograph never appeared and that the callow youth grew, greatly in size and in the appreciation of his own limitations, and the warm affection which began that day has increased steadily for thirty years. Stejneger has that quality which erases the barrier of years and which puts in its place a serene feeling of contemporaneity. This is a rare and subtle essence, which perforce must emanate, when it exists at all, from the elder of a pair of friends. Not to sacrifice the assurance which age justifies and still less to show no trace of condescension and perhaps most a willingness to listen generously, and forever to be patient, are the other great qualities which bring about an easy companionship, one in which difference of age seems to vanish. So now one of his younger friends renders a loving, if wholly inadequate, tribute to the qualities which have made Leonhard Stejneger an inspiring figure in American Science.

Diversity of interests and of talents has here been extraordinarily combined. Being an antiquarian, a classicist, a rarely accomplished linguist and a naturalist in the widest sense, he possessed a foundation on which with good health and great industry he has built a mighty structure of rarely excellent work.

These lines attempt no history nor appraisal of that work. They simply record why I am fond of him.

His friends will agree that he has cast a beneficent shadow across the face of American Natural History which will rest there for all time.

THOMAS BARBOUR



Leonhard Stejneger

By Albert Kendrick Fisher

WHEN one delves into the books and writings of authors of whose activities one has heard much related, he very naturally becomes anxious to meet the authors, inspired partly by a tinge of curiosity touching their personality but more especially by the desire to have an opportunity of talking with them over matters of mutual interest.

Fifty years ago the city of Washington, under the magic wand of Baird, interested in organizing and developing scientific bureaus, was drawing to it men trained in many lines of biology, who if not already, were soon to be widely known.

Being young and keenly interested in the various lines of biology, one can easily imagine the thrill that came to me in January, 1882, when my friend and classmate, C. Hart Merriam, suggested that we go on a pleasure trip to Washington. Here was an opportunity to see "Who's Who" among those whom I knew only from their writings or through mutual friends. Of the happenings in the strenuous week we were in Washington pages and pages could be written regarding that which was seen and heard, but more especially of the contacts with that supreme and lovable leader, Baird, and scores of other natural history workers.

At present, however, we will pass by the composite group and visit with one, with whom the dawn of friendship entered, to broaden, to mature, and to become one of the pleasures of the social and official life of the fifty years that too rapidly followed. Interested as we were in ornithology, in one of our early wanderings we ascended the narrow and winding stairway in the south tower of the Smithsonian Building to the secluded retreat, remote from the trails of the visiting crowds, where Robert Ridgway held forth surrounded by birds from many climes. Among the early formalities following our arrival in this ornithological sanctum was our introduction to a young man, whom we were told had recently arrived from Norway, who was sitting at a side table busily engaged in working over specimens of West Indian *Myadestes* for his forthcoming synopsis of the group. At this time and in this way, did I first meet Leonhard Stejneger. His combined qualities of worth appealed to me, and reciprocally something in my general make-up apparently was pleasing to him. Although we met several times in the next few days, it was not until I had settled permanently in Washington, that we became intimately associated. We shall now drop the curtain and for the moment leave our subject to bring to view some few facts which in a way will make clearer the need of the explorations touched upon later in this paper.

The great auk on account of its interesting anatomical characters, its peculiar distribution, and its woeful, tragic ending owing to the wanton

aggressiveness of man, is a subject upon which time and energy has been expended in an effort to cover in full detail that which is known of its life history. So far as records can be depended upon about eighty specimens of the bird and a slightly larger number of the eggs are extant in museums and private collections of the world. With so much attention paid to one species, it is hard to understand why Pallas cormorant, a bird fully as large and as attractive as the great auk, was allowed to disappear without more than four specimens and no eggs existing in museum collections. Maybe the lack of opportunity and the difficulty of reaching the remote habitat by naturalists is an answer to the question.

Professor Baird, in his determination to have the zoology of the area west of the Aleutian chain better known and better represented in the museum collection, may have been inspired by the magnificent work of E. W. Nelson on the Alaska fauna, which had been recently received in the form of fine series of specimens and valuable field notes. Baird undoubtedly also had in mind the hope that skeletons of the Pallas cormorant and Steller sea cow (*Rytina*) still might be found in fair condition, where once these forms were abundant. With the knowledge of the fauna of the area west of the Aleutians brought up to the level of that of Alaska, the various biological problems of this northern region would be much easier to understand. It is not strange, therefore, that Professor Baird, with his natural inborn faculty of picking out the right man for the right place, should have chosen Stejneger with his wonderful Palaearctic knowledge to make the trip to the Commander Islands. As a consequence Stejneger, under the joint auspices of the Smithsonian and U. S. Signal Service, left Washington, March 22, 1882, on two days' notice, and sailed from San Francisco on the steamer *Aleksander II,* April 5, 1882; after a rough and rather uncomfortable voyage he reached Gavan, Bering Island, May 7.

Before settling down to working out the problems relating to the fauna of Bering Island, a line of research of more than special interest to him, he went to Kamtschatka and spent a month between the middle of June and July at Petropaulski, establishing a meteorological station much needed for the purpose of securing data on weather conditions, at the time so vaguely known, as it related to this far off and little known region. In our development and advancement of Alaska it became important for the welfare and safety of northern commerce generally to have as full information as possible on the weather conditions and probabilities off to the westward of the northern Pacific Ocean.

Stejneger was very fortunate in having the opportunity of meeting at Petropaulski, Dr. Benedict Dybowski, who through careful explorations had a good knowledge of the general surrounding region. He was pleased to give any desired information from the vast store which he had gathered that in any way might be needed by those who at the time were unfamiliar with the topography or conditions.

After Stejneger's return to Bering Island during the summer he gave considerable attention to the fur seals, and studied their rookeries, and in the summer following (1883) made a trip to Copper Island to examine carefully their additional rookeries.

Later Stejneger determined to circumnavigate the island and learn more of the region on which he planned to make his winter quarters while devoting a year or more to the study of its natural history. This trip of over 120 miles was made between August 21 and September 1.

Personality makes all the difference in the world whether certain incidents are met with interest and enjoyment or with impatience and deep discomfort. Imagine, if you will, one indifferent to the pleasures of the out-of-doors, and with no special interest in natural history, making this trip with almost constant fogs, accompanied by rain with occasional sleet, wet sails for blankets to sleep under, and hordes of mosquitos which through their marked activities appeared to consider that a banquet was being furnished to them through the presence of their victim. Hardly a moment would pass when the observer was not almost covered with these troublesome insects. With such a personality, the experience would be put down probably as one of the most horrible in life. Dr. Stejneger, on the other hand, with all the instincts of a naturalist, probably overlooked all these discomforts as a matter of necessity and with the greatest interest devoted his attention to working out the problems of natural history spread before him. We should imagine that this trip was one of the eventful ones in his life, and one which he always held with cherished memories.

During this trip he spent two days in the locality where the ill-fated Bering had his winter quarters, and where he and a number of his comrades died of scurvy, from improper food and weakened condition generally, in December, 1741. Fortunately, through the advancement of our knowledge relating to food values and to the proper care of provisions during long voyages, scurvy at the present time is a rare or almost unknown disease. Although a careful search was made by Stejneger for relics that might be of historic value as relating to this tragic past, a few articles only were found. After the death of Bering, Lieutenant Waxel was in command, and to Georg William Steller, who was with him, as naturalist of the expedition, we owe much for our knowledge of the early natural history of this region, as Pallas used his journals, notes, and drawings, upon which to base his papers relating to the area.

During this forced stay of the Bering party, Pallas cormorant was abundant and furnished a considerable part of the food. As a bird weighed from 12 to 14 pounds, one was sufficient food for three of the men threatened with starvation. Later, during the long winters when natives lacked other meat such as that of the sea cow, which apparently disappeared about 25 years after Bering's visit, they fed extensively on this bird, so that through this constant pressure it reached the point of extinction soon after 1850. No where in historic times was it found elsewhere than on Bering Island. The older natives whom Stejneger questioned remembered distinctly when this fine bird still occurred on the outer rocks about 30 years (1850) previous to his visit when it still was sought after as one of the favorite foods. They knew well that the bird was gone for they laughed heartily when the Doctor offered a big reward for a specimen.

Bering Island, a treeless area with extreme elevation not over 300 feet, is 69 miles long, 28 miles at its widest point, and covers 615 square miles

in extent. One who is at all familiar with making natural history reconnaissance, especially when it includes hunting for buried fossils, can well understand the difficulty Stejneger must have had in working over such an area.

September, 1884

On sundry occasions the keen eyes of naturalists have found specimens of those things supposed no longer to exist, and it is fair to assume that Stejneger had at least a strong hope of finding a small remnant of this wonderful cormorant somewhere during his travels in the least frequented places. With keen disappointment in failing to see live birds, he got a thrill, however, when on September 1, 1882, while at Pestshanij Mys, near the northwest extremity of Bering Island, he found a deposit about two feet thick and 600 feet in extent between the turf and underlying sand, composed mainly of a mixture containing among other objects the bones of foxes, sea otters, sea lions, and seals. Lack of time prevented him from examining more than a small section of this buried osteological collection, but fortune nevertheless favored his efforts and fragments of the skulls and sterna of Pallas cormorant were brought to light. These bones were the first and only ones to go to any museum until Stejneger revisited the same deposit during the summer of 1895 and secured valuable additional material. These collections formed the basis of the two papers by Lucas on the crania and sterna of this extinct cormorant (Proc. U. S. Nat. Mus., 12, 1889, and 17, 1896).

Although the Kamtschatka sea eagle (*Thalassaetus*) had been credited to Bering Island, Stejneger was able to show that the record was due to confusion with the bald eagle, but he was fortunate in securing specimens on the mainland. He found that the two species of kittiwakes were fairly well distributed along the entire shore line of the island though the red-legged species occupied only about one-tenth part of it.

His winter residence on Bering Island enabled him to secure much valuable data on birds occurring there in that season of the year and made more complete his report on "Results of Ornithological Explorations in the Commander Islands and Kamtschatka" (Bull. U. S. Nat. Mus., No. 29, 1885). In this work which very materially adds to our ornithological knowledge of the region, he includes 140 species found on Bering Island and 186 species in the "Synopsis of the Birds Reported to Inhabit Kamtschatka." In the colored plates great pains were taken to give the natural coloring of the bills and soft parts of the birds represented.

On August 27, at Cape Tolstoj, he had the satisfaction of finding a

skeleton of the Steller sea cow (*Rhytina gigas*). Unfortunately, the bones were very fragile and he was unable to preserve more than the skull, ribs, and a few of the other larger bones. During the year or more in which he was at the island, he was able to secure at least 11 skulls and other bones of this wonderful animal. This is another animal which has perished on account of its desirability for food or for the sport of human beings. According to Brandt, it became extinct about 1763, before naturalists were really well acquainted with it.

November 11, 1923

In October, 1883, Stejneger took passage on the *St. Paul* from Petropaulski to San Francisco, arriving in Washington November 26.

In the autumn of 1883 his field operations in the Commander Islands and voyage homeward prevented him from being present in New York in September to join 23 other ornithologists in founding and organizing the American Ornithologists Union, which was the beginning of what is now one of the most progressive and well-known scientific associations in America. During the first session he was elected a member, and later during the preparation by a committee of the check-list of Northern American birds, through his wonderfully detailed knowledge of the works of the earlier European ornithologists, he was in position to render the most valuable assistance that he freely gave, in determining the proper generic or specific names of species upon which some ornithologists previously failed to agree. Some of the names which he pointed out and which were adopted in the first edition of the check-list, but which through hasty misjudgment of others were changed in the second edition, now gradually are returning to the original form as found in the first edition, thus demonstrating the accuracy of his findings.

The winter, or as a matter of fact, the entire year following his return in 1883, must have been fully occupied since manuscript was under preparation for his report on the birds of Commander Island (National Museum Bulletin No. 29) and on several orders of birds of the world to appear as the greater part of the bird volumes in the Standard Natural History, both of which came from the press in 1885. From 1884 to 1889 he was assistant curator of birds closely associated with Robert Ridgway. In his reports Stejneger very frequently calls attention to the scant credit that has been given to the National Museum for the enormous amount of cooperative work with other government agencies, museums, state and foreign educational departments, and private investigators. This fine cooperative work was started by Baird as early as 1854 and has been one of the praiseworthy activities of the Museum since its conception.

Temporary ill health, if subsequently corrected, may be a blessing in disguise as an opening of the door to opportunity which otherwise might have been unsought or unthought of. As an example of this, in the summer of 1889 Stejneger was feeling under the weather, so that G. Brown Goode, assistant secretary of the Smithsonian, always keenly awake to conditions relating to the advantage of the National Museum and to its corps of workers, saw an opportunity to capture two birds with one effort by sending Stejneger to Arizona. He probably had this especially brought to mind as Stejneger had been appointed curator of the Department of Reptiles March 1, 1889, following the resignation of Dr. H. C. Yarrow, who had served as honorary curator.

In that great out-of-doors his good health was sure to return rapidly and at the same time a splendid opportunity was given him to observe in life many of the reptiles which belong to the group he recently had taken up as a life study. "Holy Mackerel," just think of the opportunity of entering this naturalist's paradise, a *tierra incognata* to him! The writer on his first visit to this realm of wonders was keyed up to the top notch and on occasions when trogans gave their turkey calls, or messana quail attracted his attention by their conversational twitter while gleaning food from a nearby hill side, or when anthracite hawks soared overhead, he felt that happy contentment akin to the small boy who is going through his first circus experience with plenty of ice cream and cake on the side.

The time of Stejneger's visit to Arizona was very opportune since he was able to join Dr. Merriam's party engaged in making a study of the life zones of the area including San Francisco Mountain. This season with side trips from the main base gave him a wonderful opportunity, not only to study reptiles, but also the birds, mammals, and plant life of the general region.

The almost daily field contact with the reptiles was an advantage to him, especially when later he was preparing the paper on the reptiles of the region, as a chapter in North American Fauna relating to the San Francisco Mountain region. Being in company with those who had had extended field experiences in the western country, he was able to absorb many of the details of field operations, such as setting traps for small mammals and later being able to return to those which had been distributed over unfamiliar areas. Each day little points relating to the woodcraft of this new region were unfolded to him.

In 1895 Stejneger went northward to study conditions on the Russian Seal Islands.[1] With letters from the Russian Legation he left Washington May 28, arrived at San Francisco June 2 and sailed June 6 on the *Bertha* for Unalaska. He arrived there on June 17 and left on the *Albatross* June 23, arriving at St. Paul Island June 25. After spending a day on the Pribilof Islands, Bering Island was reached on July 3. Stejneger, Townsend, and Captain Drake celebrated July 4 by visiting the northern rookery by dog sled, which at that time of year is a most uncomfortable method of transportation. In fact, during his whole stay the weather was stormy and

[1] Bull. U. S. Fish Comm., 1896: 1-148, pl. 1-66.

transportation to the distant rookeries most wearisome and unsatisfactory. He left Petropaulski on the *Kotik* September 24, and arrived in San Francisco October 11. The two years following he was a member of the United States Fur Seal Commission, and in 1922, as a member of this Commission he spent three months in field work in the Bering Sea region in cooperation with the Bureau of Fisheries, returning to Washington September 20.

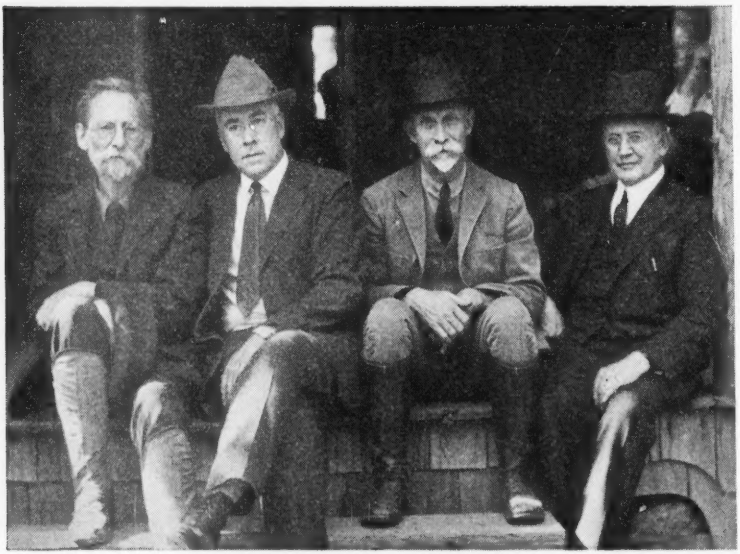
In 1911 when Frederick W. True was appointed assistant secretary of the Smithsonian, Stejneger was made head curator of biology, which met with the full approval of those in other departments, with whom subsequently he was in closer touch. In this administrative position he still had some time to devote to his special department and in 1917 the "Checklist of North American Amphibians and Reptiles" appeared, which he and Thomas Barbour prepared in cooperation for publication. This work, with a revised edition in 1923, has met with general approval and its nomenclature and classification have been generally adopted by those working in this branch of zoology.

With the competition that is going on in the world it is not strange to find those who are active made tempting offers to go elsewhere or to take up other problems. Such was an experience which came to Stejneger in 1885. Dr. Jordan, then of the State University of Indiana at Bloomington, knowing of Stejneger's spendid biological knowledge and training, made him an offer with a large increase in salary and with the privilege of remaining in Washington six months out of the year, if he would join the corps of professors at the University. Not knowing the proper action under the circumstances, he went to see Baird and showed him Jordan's letter. After some thought Baird asked if he enjoyed teaching, which Stejneger freely admitted was of little interest to him. When Baird learned that he was contented with his work at the Smithsonian, he advised him to remain in Washington.

In 1897, when there was a vacancy in the Bishop Museum in Honolulu, Stejneger was asked to consider the position. In effect, he told Bishop, who came to see him, that if he would be allowed full control he might give it thought. At the request of Bishop he prepared a comprehensive plan for a museum covering the rapidly vanishing terrestrial life of the various Pacific islands including those of the South Seas. The plan was to take up first the fauna of the Hawaiian Islands, and then subsequently, as rapidly as practicable, to add that of the other groups of islands until all were included. It was thought that if he should decide to take charge, the museum might, at least, eventually become a branch of the National Museum. Although matters came up that made it impracticable for Stejneger to organize this museum, it must be remembered that his fine draft for biological explorations was in existence 30 years before the one adopted by a committee in 1927.

As an official representative of the Smithsonian Institution and State Department at the International Ornithological Congress in London, in 1905, and the International Zoological Congresses at Berlin, in 1901, Berne, 1904, Boston, 1907, Monaco, 1913, Budapest, 1927, and Padua, 1930, Stejneger had opportunity of meeting the leading zoologists from

the various countries present at the meetings and learn from them the more important zoological problems, which at the time were of special interest at their homes. On these occasions which took him abroad, wonderful opportunities were given him to visit museums to study types and other specimens so as to be able to clear up perplexing problems relating to some of the American species described by the earlier writers. He also



Dr. Stejneger, W. R. Maxon, Dr. T. W. Vaughan, and W. E. Safford
at Plummer's Island, April 30, 1922

was able to study museum administrative matters and to glean points of special interest that later might be recommended to American institutions for consideration.

One of Stejneger's noteworthy charms is the ease in which he can be approached by those seeking information along lines of mutual interest, or by those desirous only of acquaintanceship. Generalizations or minute details are forthcoming to fit the occasion in accordance with the desire of the visitor. Biologists from abroad coming to Washington were almost sure to look up Stejneger and in this way his friends got in touch with men of note whom they otherwise might never have met. His home in Brookland, among clustered trees, close to those of Robert Ridgway and Walter Barrows, was an open house to his friends, the center of hospitality and good fellowship. Here many a pleasant evening has been spent, with local friends and foreign visitors, all forgetting their worries and entertaining one another by recitals of past events, the happenings of the day, or the approaching problems of the morrow. Around the well-provided table contentment reigned as one day passed into another. The

final partings were the only things that seemed to carry any vestige of regret.

Later, in 1915, when he transferred his home to the city, his friends continued to meet with him, even though the critical times bore heavily on their minds and made it hard to forget for the moment the cloud that was threatening civilized humanity. With his more intimate friends Stejneger would talk of Bergen, his birthplace, of Christiana, where he received his degree from the university, and of other noted places in Norway. He also often told of interesting trips which he had made through various parts of Europe. These places were away from the tourists' trails, where the inhabitants were natural and not perverted by the ignorance of inexperienced traveling people. Knowing and speaking many of the languages, he was welcomed at the hamlet or elsewhere if by chance night overtook him.

With exercise in the open air, and with no temptation to use tobacco, Stejneger has kept in good physical condition, for excepting in very inclement weather, he walks to and from the office, probably traveling in the aggregate four or five miles daily. He enjoys the pastime of dancing and with his well-controlled muscles and lightness of step, is very graceful in all his movements.

Returning home one night years ago, when Washington was a younger town, he had an experience which probably few people have had, at least in America. In these early days when the roots of the rapidly growing shade trees made the brick sidewalks very uneven, and the curse of the automobile yet was unknown, pedestrians for comfort would walk in the middle of the street, especially on cloudy nights in the period of the full of the moon, when according to custom the gas lamps were not lighted. On the night in question Stejneger was strolling leisurely home up the middle of the street when all at once he became conscious of a peculiar local darkening mass ahead. As this seemed to increase in density as he advanced he stepped to the edge of the street when almost at once to his amazement a full-grown elephant brushed noiselessly by and disappeared in the darkness beyond. Next day through the papers he learned that the animal had escaped from a visiting circus.

Stejneger had a great admiration for Baird even before he met him, and once while we were walking through the Smithsonian grounds he pointed out with interest a seat where he sat and brushed up a little on his vocabulary just prior to his first interview with Baird.

When we had been close friends for a third of a century it gave us thrills to extend to each other a dinner in celebrating the event, and if all goes well next January (1932) we plan to commemorate our half century of continuing friendship in as befitting a manner.

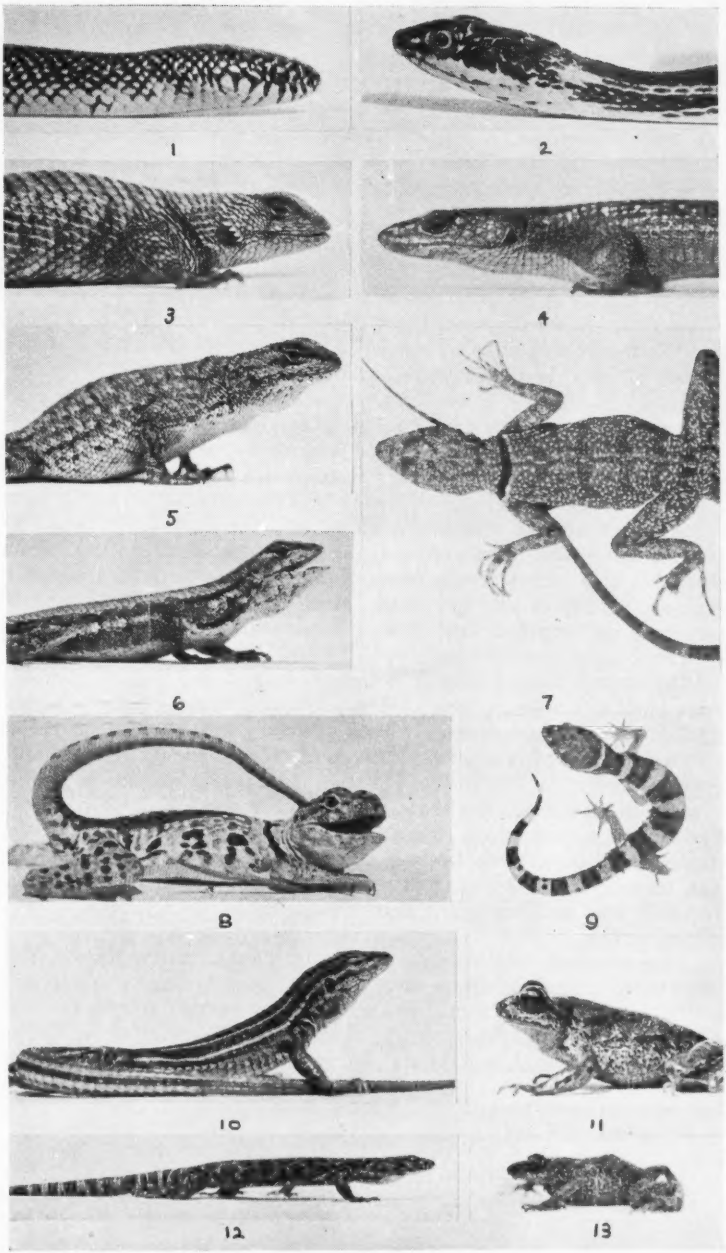
United States National Museum, Washington, D. C.

Some Stejneger Species Photographs From Life

By Anna Allen Wright and Albert Hazen Wright

1. *Lampropeltis getulus holbrooki* (Stejneger).
   Proc. U. S. Nat. Mus., Vol. 25, Sept. 8, 1902, p. 152.
   From Little Rock, Ariz., March 20, 1930. C. L. Shilliday.
2. *Coluber taeniatus girardi* Stejneger and Barbour.
   Check List N. Amer. Amph. Rept., Ed. 1, 1917, p. 80.
   From El Paso, Tex., Nov. 1, 1925. Col. M. L. Crimmins and Mrs. R. B. Alves.
3. *Sceloporus orcutti* Stejneger.
   N. Amer. Fauna, No. 7, May 31, 1893, p. 181, pl. 1, figs. 4a-c.
   From Palm Canyon, Cal., Apr. 23, 1929. L. M. Klauber and G. S. Myers.
4. *Gerrhonotus palmeri* (Stejneger).
   N. Amer. Fauna, No. 7, May 31, 1893, p. 196.
   From Yosemite, Cal., Oct. 5, 1929. C. A. Harwell.
5. *Sceloporus elongatus* Stejneger.
   N. Amer. Fauna, No. 3, 1890, p. 111.
   From Salina, Utah, May 27, 1929. J. S. Stanford.
6. *Sceloporus woodi* Stejneger.
   Proc. Biol. Soc. Washington, Vol. 31, June 29, 1918, p. 90.
   From Lake Placid, Fla., June 12, 1928. A. A. & A. H. Wright.
7. *Uta mearnsi* Stejneger.
   Proc. U. S. Nat. Mus., Vol. 17, Nov. 30, 1894, p. 589.
   From Andreas Canyon, Cal., Aug. 23, 1895. A. A. & A. H. Wright.
8. *Crotaphytus collaris baileyi* (Stejneger).
   N. Amer. Fauna, No. 3, 1890, p. 103, pl. 12, fig. 1.
   From Devil's River, Tex., July 1, 1925. A. A. & A. H. Wright.
9. *Coleonyx brevis* Stejneger.
   N. Amer. Fauna, No. 7, 1893, p. 163.
   From Helotes, Tex., June 23, 1930, C. H. & H. Gable & A. H. W.
10. *Verticaria hyperythra beldingi* (Stejneger).
    Proc. U. S. Nat. Mus., Vol. 17, May 4, 1894, p. 17.
    From Telegraph Canyon, Cal., May 16, 1930. B. C. Marshall.
11. *Ascaphus truei* Stejneger.
    Proc. U. S. Nat. Mus., Vol. 21, June 20, 1899, p. 900, figs. 1-4, pl. 89.
    From Carbon River, Wash., May 16, 1930. J. R. Slater.
12. *Xantusia henshawi* Stejneger.
    Proc. U. S. Nat. Mus., Vol. 16, July 21, 1893, p. 467.
    From Jamacha, Cal., Apr. 1, 1928. L. M. Klauber.
13. *Syrrhopus campi* Stejneger.
    Proc. Biol. Soc. Washington, Vol. 28, June 29, 1915, p. 131.
    From Brownsville, Tex., Apr. 28, 1925. R. D. Camp, A. A. & A. H. Wright.

Cornell University, Ithaca, New York.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Note on the Color Pattern of *Hynobius stejnegeri* Dunn

By Junji Oyama

HYNOBIUS stejnegeri Dunn is a urodelan species established as new by E. R. Dunn in 1923.[1] The specimen used by him as the type was the one that had been described as *Hynobius naevius* (Schlegel) by Stejneger in 1907.[2] The reason why Dunn regarded this animal as a new species rests principally on its difference in the pattern of markings from that of *H. naevius*. In the diagnoses given for *H. stejnegeri* and for *H. naevius*, he states the color patterns respectively as "light markings present on whole surface of body" and "light markings only on sides and belly."[3]

These descriptions, however, were made from specimens whose original colors had been lost during many years of preservation, and we can no longer recognize the original color patterns of the animals from these statements. In the spring of 1930, I received two preserved and ten living specimens of salamanders, all of them undoubtedly belonging to the same species. They were all adult and collected at Umamihara, Kumamoto Prefecture, in Kyûshû. The examination of these specimens led me to conclude that they were referable to *H. stejnegeri*, and now I fully acknowledge the validity of this species of Dunn. In this connection I wish to mention a few words about its true color pattern, because it has, as far as I am aware, not been described.

The original coloration of *H. stejnegeri* is black and yellow: variously shaped yellow markings occur on the black background. Exactly speaking, the black is rather brownish black and the yellow is cadmium yellow with a little tinge of orange. Both colors are vivid while the skin is somewhat translucent, so that the color pattern immediately reminds us of tortoise-shells. However, the shape, size, number and distribution of the markings vary according to individuals. Some have markings all over the surface of the body, while others lack them on the belly. In some individuals, markings are very small in size and few in number. Some others that show this tendency to the extreme, are totally black, devoid of any yellow marking.

As seen in preserved specimens, the color of the markings when fully faded away appears, as Dunn says, equally "light" in both *H. stejnegeri* and *H. naevius*. But in life the two species differ entirely from each other in the color of their light markings, which in *H. stejnegeri* are yellow as stated above, but in *H. naevius* are silvery gray.

Zoological Laboratory, Kyûshû Imperial University,
Fukuoka, Japan.

[1] Proc. Cal. Acad. Sci., (4), Vol. 12, No. 2.
[2] U. S. Nat. Mus. Bull. 58.
[3] Proc. Amer. Acad. Art. Sci., Vol. 58, No. 13.

A New North American Lizard

By Thomas Barbour

EARLY in May, 1931, my friend Mr. A. G. Elbon of Key West, sent me a beautiful male lizard which he presumed was *Anolis sagrei* and an accidental waif from Cuba. A glance showed that this identification was wrong but I made an equally mistaken one when I suggested to Mr. Loveridge that it looked like *Anolis homolechis*. We began to search in earnest and soon became completely baffled and suspected something entirely new. When neither Mr. Loveridge nor I could find a near ally for this species, I did what one usually does under such circumstances; that is, say, "Send it to Stejneger."

It seems almost as if this surprising find, and the romantic story which this discovery uncovers, had been providentially timed for this Anniversary Number of Copeia, which honors our friend. The following letters are self explanatory:

June 1, 1931

Dear Barbour:

The Anolis arrived a few minutes ago—I have waited for it forty years! for I have the female to match your male! We have here called it *Anolis cooperi* Baird, but I knew better.

Baird's types have apparently been lost. Cope in 1862 evidently had access to them—with the usual result. Our record book has the following original entry:
"4165. Anolis—California. Dr. Cooper. 2 [meaning 2 specimens]. Found in bottle of Scelop. occidentalis from Calif. 2871."
What the real origin of the types was, is now impossible to say.

In Yarrow's Check List (Bull. U. S. Nat. Mus., No. 24, 1882, p. 72) you will find enumerated under *Anolis cooperi* Baird, U. S. Nat. Mus. 'No. 6002, Cape Punta, Fla.' The record book has only 'Cape Punta,' and no collector. 'Fla.' is a guess (?) of Yarrow, for I can find no such locality. However, way back in some pigeonhole of my brain I have registered the impression (?) that the specimen was collected by Würdemann. Now, among other places, he collected also around Charlotte Harbor, Florida, and as both Punta Gorda and Punta Rasa are located on that body of water, I have ventured the guess that the specimen was collected somewhere about there.

The question now arises: Is this really Baird's *A. cooperi*? His diagnosis is very brief but very much to the point. The first sentence settles it: "Cephalic scales smooth." So that, whatever our specimens are, they are not *cooperi!*

I am sending you our 6002 in the same bottle with yours, so that you may see for yourself and use it in your description of this interesting addition to the U. S. fauna. I have little doubt that it is undescribed, so ours will be a paratype anyhow.

Now a word as to why I have kept quiet about our specimen these many years. It came under my observation shortly after I took charge of the reptile division in 1889, and I soon became convinced that it was misnamed. I was sorely tempted to describe it as new, but the uncertainty of the type locality held me back, for if my guess as to Charlotte Harbor being the place were correct, surely additional specimens would soon turn up, so why not wait? And so I have waited more than 40 years. The moment I received your letter my suspicion was aroused and I got the specimen out and it has stood on my desk for nearly a week in expectation of the arrival of the mate!

I will have both specimens mailed tomorrow, as I want Miss Cochran to see them before sending them away.

Sincerely yours,
Leonhard Stejneger

June 2, 1931

Dear Barbour:

Since writing yesterday I have searched our unidentified old Anoles once more, but the types of *A. cooperi* are certainly not among them.

A point which has to be met is the following: Cope (Proc. Acad. Nat. Sci. Philadelphia, 1862, p. 181) compares *A. maculata* with *cupreus, sagraei* and *A. cooperi*. If the latter had smooth head scales it is strange that he should not have mentioned it. In that case 'Cephalic scales smooth' must have been a slip of Baird's pen. However, I do not believe we would be justified in rejecting his plain words on such a suspicion. The safest course is to go ahead and describe it.

Yours as ever,
Leonhard Stejneger

The natural impulse of any decent naturalist would have been to return this creature for Stejneger to describe and I had a letter of transmittal drafted to do so, but the chance, at this time and place, to describe what may well be the last conspicuous North American novelty was overwhelming and so, tempted and falling, I dedicate this new species to our greatest herpetologist, to be called:

Anolis **stejnegeri,** sp. nov.

Type:—An adult male, Mus. Comp. Zool. No. 29907, collected April 20, 1931, on the handrail of a small bridge over a salt water ditch, in a bare rocky area, far from any vegetation, Key West, Florida. Paratype, female, U. S. Nat. Mus. 6002.

Not very distantly related to *A. ahli* and *A. mestrei* of Cuba but having heavily keeled ventral scales, and a dewlap which is deep carmine, the scales grayish, the anterior portion of the fan dark maroon but the anterior edge ivory white. The fan shows as a broad, white streak while it is closed.

Description:—Top of head with widely separated and ill defined frontal ridges; head scales rough, obtusely keeled, those of the supraorbital disks sharply keeled, those in the perioccipital area rather rounded, roughly tubercular; rostral row, slightly narrower than the mentals, about five scales in a series between the nostrils; supraocular semicircles ill defined, separated by but one or two rows of scales; occipital as large or slightly larger than ear opening, separated by two or three rows of scales from the supraocular semicircles; supraorbital disk consisting of about 9 or 10 enlarged scales, the larger of which lie in a mesiad position, the disk separated from the semicircles by one row of granules and by 2, 3 or 4 rows from the supraocular scales; canthus rostralis well defined, consisting of several elongated scales running from above the center of the eye and becoming indistinct a short distance before the nostril is reached; loreal rows 5, scales elongated, loreal region slightly concave, supralabials four to beneath the center of eye, then 2 or 3 much smaller behind these; temporals tubercular, a supratemporal line of 2 rows of enlarged scales faintly indicated; mid-dorsal scales slightly enlarged and keeled, merging gradually into the lateral scales which are smaller and rather tubercular; ventral scales much larger than largest dorsals, imbricate, rather pointed apically and sharply keeled; anterior side of forelimb with large, flat, imbricating keeled scales, as large as the largest ventrals, those on tibia and femur similarly enlarged;

scales on upper side of fingers pluricarinate, on the upper side of toes similarly but faintly marked; about 32 lamellae under phalanges 2 and 3 of 4th toe; tail compressed, keeled above with enlarged scales on upper edge in verticils of 4, equalling about 6 to 8 of the small lateral scales separating the verticils on the side of the tail; postanal scales but very slightly enlarged.

There is no indication of dermal folds on neck or back.

Color of fresh specimen in formalin: apparently bright green in life, throat faintly rayed with darker green; gular fan carmine at base, slightly darker, almost maroon anteriorly, scales showing as ashy grey dots, while anteriorly the border is broadly and conspicuously ivory white. Thus, with the fan at rest, a wide, white gular streak is to be observed; which must be very diagnostic in the field.

Total length	156 mm.
Tip of snout to vent	47 mm.
Vent to tip of tail	109 mm.
Tip of snout to ear	15 mm.
Width of head	9 mm.

Female paratype differs from the male in having a slightly narrower head, slightly smaller, less strongly keeled and less sharply pointed ventral scales; the dewlap, of course, is absent and the tail is more nearly round, much less serrate above (U. S. N. M., No. 6002).

I saw once, years ago, a lizard which now I believe to have been this species, in the mangroves of, I think, Big Coppitt Key, but it was not taken and the fact lay forgotten for years. I suspect this species will be found to be an inhabitant of the mangroves of extreme southwestern Florida and the Keys.

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASSACHUSETTS.

A New Lizard from Haiti (*Sphaerodactylus stejnegeri*)

By DORIS M. COCHRAN

THE possibility of discovering many more species of reptiles on Hispaniola, the least-known of all the Greater Antilles, is suggested by the fact that intensive collecting in any region on the island almost invariably yields one or more forms new to science. While the caves of St. Michel, Département du Nord, Haiti, were being excavated primarily for bones of mammals and birds, some living reptiles were secured and preserved, among which was a small lizard which appears to be undescribed. I take pleasure in naming the species in honor of Dr. Leonhard Stejneger, Curator of the Division of Reptiles and Amphibians, United States National Museum.

Sphaerodactylus **stejnegeri,** new species

Sphaerodactylus sputator (not of Sparrman) Boulenger, Cat. Lizards Brit Mus., 1, 1885: 219 (part) (San Domingo).

Sphaerodactylus torrei (not of Barbour) Barbour, Mem. Mus. Comp. Zool., 44, (2), 1914: 260 (part) (Santo Domingo); Mem. Comp. Zool., 47, (3), 1921: 230 (part) (Thomazeau, Haiti).—Barbour and Ramsden, Mem. Mus. Comp. Zool., 47, (2), 1919: 85 (part).—Cochran, Proc. U. S. Nat. Mus., 66, (6), 1924: 3 (Southwest Haiti).

Diagnosis.—Dorsals imbricate, smooth, 14 to 16 in the standard distance between center of eye and tip of snout; no differentiated mid-dorsal zone.

Type.—U. S. Nat. Mus. No. 76640, an adult from St. Michel, Département du Nord, Haiti, collected December 21-31, 1928, by A. J. Poole and Watson Perrygo.

Description of the type.—Snout moderately short and broad, its length two and one-half times the diameter of the eye; eye slightly nearer ear than tip of snout; rostral large, with a median groove behind; nostril between rostral, one large supranasal, a postnasal and the first supralabial; supranasals separated from each other by a single scale; superciliary spine moderate in size; four moderately large and a very small fifth supralabial to a point below the center of the eye; four infralabials up to the same point followed by a fifth very small one, the whole series decreasing in size regularly; top of head covered with smooth, flat, polygonal scales which are fairly equal in size on snout and on occiput, becoming small only on the supraocular region; scales of back small, smooth, slightly imbricate, about 14 equalling the standard distance from tip of snout to center of eye; no mid-dorsal granular zone; mental large, followed by two enlarged postmentals; scales of gular region very small, smooth, imbricate; scales of chest and belly smooth, rounded, imbricate, about 10 ventral scales to the standard distance, not perfectly regular in size; scales of limbs anteriorly and below like those of the belly, much smaller and granular posteriorly; 14 smooth lamellae under the fourth toe; scales of tail above smooth, rounded, slightly imbricating, below on the median line enlarged transversely into a series of very irregularly shaped plates.

Dimensions.—Head and body, 31 mm.; tail, 27 mm.; width of head, 5 mm.; tip of snout to ear, 7.5 mm.; fore leg, 7 mm.; hind leg, 9 mm.

Coloration in alcohol.—Upper parts drab with a powdering of minute sepia dots; a sepia line beginning on the tip of the snout, continuing on the canthus and widening abruptly behind the eye, where it soon merges with a wide transverse bar of the same hue which crosses the occiput leaving the entire top of the head from occiput to tip of snout light; a second transverse sepia bar across the neck in front of the shoulders and two similar ones on the body; all the transverse bars with rather irregular outlines, bordered in front and behind by a light area, the interspace between these areas punctate with light sepia markings, and slightly exceeding in extent a single sepia bar with its light bordering areas; tail with five dark bars similar to those on the body, interrupted beneath; lower surfaces of body uniform pale drab, with a faint suggestion on the throat

of the continuation of the two anterior sepia bars; labials without any color pattern, but with a heavy powdering of minute sepia dots; limbs with pale sepia markings above; a short longitudinal sepia line between the eyes.

Paratypes.—A lizard from southwestern Haiti, U. S. Nat. Mus. No. 60617, collected by Dr. W. L. Abbott, is quite similar to the type in scalation; the dorsals are slightly smaller, however, about 16 to the standard distance, and on the anterior part of the body they are perhaps less imbricate. The dark crossbars, while identical in number and position, are much wider and heavier in the paratype, and their outlines are very regular. They extend a little farther down the sides toward the ventral region in the paratype, and likewise are far more obvious on the throat, the occipital band completely crossing the throat, and the band following it having but a narrow interruption on the middle line. The dark lines on the canthus and between the eyes are also accentuated and broadened in this individual. The labials have scarcely any concentration of pigment on them, and the markings on the upper surfaces of the limbs are very inconspicuous. The much mutilated individual collected by Dr. G. M. Allen in Thomazeau (now Mus. Comp. Zool. No. 13481) is clearly of this species also.

Relationships.—When the lizard now named as a paratype of *stejnegeri,* 60617, was first examined, both Dr. Barbour and I considered it the same as the Cuban *Sphaerodactylus torrei* and I called it so in the report on the Abbott collection. Closer study proved them to be quite distinct, however. The pattern of *torrei,* at first glance so similar to the Hispaniolan form, upon analysis proves to be different. For example, there are three, or traces of three, wide dark-edged bars on the body of females of *torrei,* separated by a narrow, uniformly light area. In *stejnegeri,* we find two uniformly dark and relatively narrow bars, having light borders and separated by relatively wide interspaces which are spotted with pale brown dots and markings. The head pattern is equally definite in the two species,—*torrei* has a definite white band preceding the dark occipital bar, with nearly the entire region in front of this dark, while in *stejnegeri,* the whole head in front of the occipital bar is light. The Cuban form has much smaller dorsals—18 to 23 equalling the standard distance—but the new species has larger dorsals which are imbricate, at least on the posterior part of the body. The Cuban species has smaller scales on top of the head, on the center of the throat and between the eye and ear, while the new Hispaniolan lizard has comparatively larger scales in these areas. The snout of the adult cotype of *torrei* is relatively longer and more pointed than is the case in any of the Hispaniolan lizards. The fourth toe of *torrei* has more lamellae also.

The new form, having small, smooth imbricate scales, falls next to *glaucus* from Mexico in Dr. Barbour's key although it can scarcely be regarded as an actual derivative of *glaucus.* It is much more likely that it was derived from one of the West Indian forms having no differentiated mid-dorsal zone and more or less weakly keeled scales.

Division of Reptiles and Amphibians, United States National Museum, Washington, D. C.

A New Snake of the Genus *Typhlops* from the Belgian Congo

By Arthur Loveridge

THE following description of a burrowing blind snake of the family Typhlopidae is based on two specimens in the United States National Museum, which were submitted to me for identification by Miss Doris M. Cochran, to whom I am much obliged for the privilege of describing them. When writing to Miss Cochran that I regarded them as new she replied that she found that many years ago Dr. Stejneger had written "Type" opposite No. 23980 but that no name had been assigned to it and he would be glad if I would publish the description already written. I have great pleasure in naming it in honor of Dr. Stejneger, who has done so much for herpetology.

This new form is intermediate between *T. caecus* and *T. graueri* but differs from both in many characters, chief of these is the presence of only two labials, one normal and well-developed, the posterior almost rudimentary. It agrees with *T. caecus* in possessing a preocular but has more numerous midbody scale-rows (26 instead of 22), a stouter body, and different head shields.

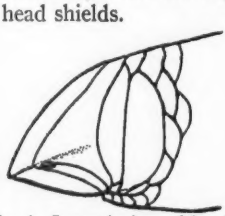

Fig. 1. Lateral view of head of *Typhlops stejnegeri.*

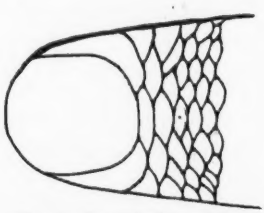

Fig. 2. Dorsal view of head of *Typhlops stejnegeri.*

Typhlops ***stejnegeri,*** sp. nov.

Type.—No. 23979, United States National Museum, from Luebo District, Belgian Congo. Collected by Rev. D. W. Snyder.

Paratype.—No. 23980, with same data as the type.

Description.—Snout strongly projecting, with sharp horizontal edge; nostrils inferior; rostral very large, rounded posteriorly, in contact with a moderately elongate internasal, separated from the preocular by the nasal; nostril touching the rostral, a long suture extending from the nostril to the anterior upper labial; a narrow preocular present, three times as long as broad, its breadth rather more than half that of the ocular, situated immediately above the anterior labial; ocular as high as, and broader than, the preocular, separated from the buccal border by an exceedingly small posterior labial; eyes not distinguishable; two upper labials, a large anterior and minute posterior. Diameter of body 46 (53 in paratype) times in the total length; tail broader than long, ending in a spine; 26 midbody scale-rows.

Coloration.—Uniform yellowish white in alcohol.

Measurements.—Total length, 418 mm. in type, 424 mm. in paratype

Diameter at midbody 9 mm. in type, 8 mm. in paratype

Length of tail ..... 5 mm. in type, 5 mm. in paratype

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASSACHUSETTS.

A New Toad from Korea

By KARL P. SCHMIDT

A SINGLE specimen of a strikingly distinct and hitherto unknown species of toad (*Bufo*) is included in a collection of amphibians and reptiles representative of the Korean fauna received by Field Museum of Natural History from Mr. L. H. Snyder of the Songdo Higher Schools, Songdo, Korea. It is an especial pleasure to attach the name of Dr. Leonhard Stejneger to this species since it belongs to a fauna long a favorite with him and one in which his studies laid the foundations for subsequent systematic work. The new form may be called:

Type of *Bufo stejnegeri*, sp. nov., natural size

Bufo ***stejnegeri,*** sp. nov.

Type from Songdo, Korea (Chosen), Field Museum of Natural History, No. 11417, collected by L. H. Snyder, 1930, adult female.

Diagnosis.—Distinguished from other species of *Bufo* in northeastern Asia by the shortness and width of the parotoid glands, by the long and relatively slender limbs, and by the complete concealment of the tympanum.

Description of type.—Snout transversely and vertically truncate with a median groove above; canthus rostralis well defined, loreal region slightly concave; nostrils close to the tip of the snout; interorbital space flat, nearly twice as wide as the upper eyelid; no long ridges on head; tympanum indistinguishable; parotoid glands nearly as broad as long, not much swollen, their length contained more than eight times in that of the body; limbs slender, heels meeting when limbs are placed at right angles to axis of body; fingers very slightly webbed, the first and second equal in length; two large palmar tubercles; web of toes deeply emarginate; inner and outer metatarsal tubercles subequal, rounded; tarsal fold barely indicated by partially confluent series of tubercles; some of the subarticular tubercles double; back covered with nearly uniform small warts with an indistinct Λ-shaped series between the shoulders and a well defined dorsolateral row on each side; under surfaces granular; color (in alcohol) grayish brown above, lighter on the sides and beneath, without distinct markings.

Measurements of type.—Length from snout to vent 56.1 mm.; greatest width of head 19.6 mm.; arm 35.4 mm.; leg from anus 72.2 mm.; tibia 22.7 mm.; parotoids 7.3 and 6.4 mm. in length and 6.6 and 5.2 mm. in width.

Remarks.—The combination of short and wide parotoid glands, concealed tympanum, and slender limbs is otherwise unrepresented among Chinese toads. *Bufo koslovi* Zarevskij, from southern Mongolia, has an indistinct tympanum, but is otherwise unrelated to the new form. It is highly surprising to find an undescribed species, so well characterized, from this relatively well known area.

Field Museum of Natural History, Chicago, Illinois.

The Original Descriptions of *Bufo fowleri* and *Bufo americanus*

By George S. Myers

THE name *Bufo fowleri* is now generally credited to Garman, on the basis of a short diagnosis appearing in the Bulletin of the Essex Institute (16, 1884: 42). It is well known that Putnam was the actual author of the name and that he very likely described the species in manuscript, the name having appeared, credited to him, in Cope's 1875 *Check-*

list (p. 29), and in the latter's *Batrachia* (1889: 279). Putnam seems never to have published his description.

Although Garman's 1884 diagnosis long antedates that of Cope, 1889, there is another description antedating even that of Garman. In 1882 (Proc. Boston Soc. Nat. Hist., 21: 307-314), Mary H. Hinckley published a paper on the tadpoles of Milton, Massachusetts, and in this she distinctly differentiates the tadpoles of *americanus* and *fowleri* and gives notes on the habits and distinctive call of the latter species. On page 310 she refers to the toad as *Bufo fowleri* Putnam. It would appear that this must constitute the original description.

When we come to the authorship of the name a question arises. Miss Hinckley credited the name to Putnam, as did both Cope and Garman. Article 21 of the International Rules states: "The author of a scientific name is that person who first publishes the name in connection with an indication, a definition, or a description, unless it is clear from the contents of the publication, that some other person is responsible for said name *and* its indication, definition, or description." The "and," which I have italicized, is important. It is evident that Miss Hinckley did not intend to present the original description of Putnam's species and that she was not responsible for the name. It is equally evident that Putnam had nothing to do with her "indication, definition, or description." According to the clause of Article 21, as interpreted with the italicized "and," the conditions for recognized authorship of the name in this case require responsibility for *both* name *and* "indication, definition, or description." It seems clear that "some other person" (Putnam) has not fulfilled the requirements of the said clause and that therefore the authorship should go to Miss Hinckley.

This interpretation appears applicable to Garman's 1884 description as well as to Cope's 1889 one, and probably also to the name *Aneides aeneus* Cope and Packard, reversing the opinion I expressed in COPEIA (170: 73).

Now that the description of *Bufo fowleri* Hinckley seems clear, we may proceed to examine another complication. In examining Holbrook's original (1836) account of *Bufo americanus* (*North American Herpetology,* Ed. 1, 1: 75, pl. 9) there is found considerable evidence to show that it is based largely on the animal we now call *Bufo fowleri.* His plate, showing the enlarged spots on the back, the typical *fowleri* parotoids, and the immaculate venter, is certainly based on *fowleri,* though the color is not right. Possibly it is a composite, but the anatomical details and plain venter cannot be mistaken.

Going through his description carefully we note the following. The generic diagnosis gives no help. The specific diagnosis gives little more, but states "post-tympanal (parotoid) gland narrow and much elongated." This perhaps better describes *"americanus"* than *fowleri* but is uncertain at best. In the "Description" there again is much irrelevant. We learn that "The eyes are large and brilliant; the pupil . . . . of black and gold." While a golden iris is more distinctive of *"americanus"* than of *fowleri,* many of the latter have a distinctly golden iris; there is nothing definite

here. Once more "the post-tympanal glands are narrow and very long, almost semi-cylindrical"; once more the same comment. "The body . . . . has its superior surface covered with warts of different sizes." Again a shade nearer to *"americanus,"* but again true of both. Then of the dorsal spots—"we sometimes find them systematically arranged in rows." This is a typical *fowleri* character, but there is a slight possibility of *"americanus"* entering. "Along the flanks is a broad but indistinct band, extending to the posterior extremities; this band is so broken as to give the appearance of a row of black and white spots." This well describes some *"americanus"* individuals, but considering the character of Holbrook's description, is equally applicable to some of *fowleri.* "The abdomen is granulated, *and of a dirty yellowish white."* (Italics mine.) Holding in mind the plate also, I do not believe that Holbrook, had he had no specimens of *fowleri* before him, would have written this. "The posterior extremities are short, their superior surface ash-color." This certainly much better describes the color of *fowleri* than of *"americanus."* "Length from snout to vent, 2½ inches." Another strong indication of *fowleri.* Evidently Holbrook considered this an average size, and it is of adult *fowleri,* but adults of *"americanus"* are usually larger.

Under "Geographical Distribution" and "Habits" there is enough to show conclusively that Holbrook at one time or another had actually observed *"americanus."* The specimens from "the mountains of Maine" must have been this species. The statement that he had "never met with it in the low country of South Carolina although common in the upper districts of the state," while indicative of *"americanus,"* is merely negative and proves nothing. That the species spawns "early in the spring" and that the call is "a prolonged trill" indicates that he had observed *"americanus,"* but that the call is "not unpleasant when at a sufficient distance" allows a suspicion of *fowleri.* Nothing else in the account helps us any.

It is evident that Holbrook confused the two species, or, rather, that he had no inkling that he had been observing two. To the writer it appears possible to regard the description itself as based entirely on *fowleri,* as the plate surely is. The account of the habits, call, and range, however, show that Holbrook must have been familiar with *"americanus."* I have sought the advice of Dr. Carl L. Hubbs, Mrs. Helen T. Gaige, and Dr. Remington Kellogg on the matter and all three have advised that the account be considered a composite, a view with which I concur.

In this case it devolves upon the writer, as "first reviser," to designate which of the two included species shall bear the name *americanus.* I therefore restrict the name *Bufo americanus* Holbrook to that species which has in recent years been known by that name, as represented by the descriptions of *Bufo americanus* given in Dickerson's "The Frog Book" (1906), Wright's "Anura of Ithaca" (1914), Jordan's new "Manual of the Vertebrates" (1929), etc.

It may be noted that Holbrook's reference of the name *americanus* to Le Conte goes the way of Hinckley's reference of *fowleri* to Putnam.

NATURAL HISTORY MUSEUM, STANFORD UNIVERSITY, CALIFORNIA.

Observations on the Life History of *Ascaphus truei* Stejneger

By G. K. Noble and Phillips G. Putnam

WE are glad to present in this number of Copeia dedicated to Dr. Leonhard Stejneger a summary of our observations on the life history of the most primitive frog in America, a genus and species described by him thirty-two years ago. A full report of our observations together with illustrations are reserved for later publication.

The field observations reported below were made during the summer of 1930 on the east slope of the Olympic Mountains, in the vicinity of Lake Cushman, Washington. A series of specimens, both adults and larvae, were shipped alive in iced containers across the continent to New York. There several pairs mated and it was interesting that the details of the mating process observed by one of us in the field and by the other in the laboratory were found to be alike. All the field observations were made by Putnam while the laboratory studies, including notes on the ovulation and early development of *Ascaphus,* were recorded by Noble.

Ascaphus truei appears to be uniformly distributed throughout the area under consideration. Adults, as well as larvae, are found most frequently in the shallow mountain streams, the adults usually hiding beneath stones. At night the adults have been found to leave the stream and crawl about on the banks. During cool, wet weather, the adults leave the vicinity of streams for several have been captured at such times away from water. Conversely, during dry, warm weather, larger catches were made in the streams than at other times. At elevations from 200 to 3500 feet above sea level, adults and larvae appear to be confined to streams surrounded by forest. Removal of the timber by lumbering or by fire results in the disappearance of *Ascaphus* apparently on account of the increased temperature of the exposed stream bed. Above timber line streams containing *Ascaphus* may reach a maximum temperature of 16° C (August 27). *Ascaphus* does not appear in streams possessing a large amount of decaying vegetation or lacking exposed stones which provide areas of attachment for the tadpoles and recesses in which the adults may conceal themselves. The larvae are always found in running water. Both larvae and adults are rare in the larger streams, apparently because of the trout which are known to feed on them.

The breeding season of *Ascaphus* is an extended one. Pairs in embrace were taken in the field from June 12 to July 6. Females with distended ovaries were secured throughout July and a male collected September 4 attempted to embrace in the collecting bottle. Unlike most other Salientia, *Ascaphus* is voiceless. No sounds were emitted before or during mating,

and no vocal organs are found in the males. Fertilization is known to be internal, spermatozoa having been found in the oviduct of the female (Noble, 1925[1]). The male *Ascaphus* differs from all other Salientia in possessing an extension of the cloaca which was assumed to function as a copulatory organ, since breeding males were found to extend the appendage forward under the abdomen (Noble, *loc. cit.*). Spines have been found within the orifice of this appendage (Noble, 1931[2]) and it has been suggested that the organ was merely pressed against the cloaca of the female during copulation, the spines serving to maintain the position. The very recent observations of Slater (1931[3]) confirm the earlier observations of Noble but the question still remains of whether the cloacal appendage of *Ascaphus* actually serves as an intromittent organ. Fortunately our field and laboratory observations have now definitely settled this question.

Ascaphus is not only voiceless but is provided with lungs of small size (Noble, 1931[4]). The reduction of lungs which function as hydrostatic organs, would permit the males to crawl about on the bottom of mountain streams in search of females. In the laboratory tanks cooled from 5.7° to 10.7° C, the males were most active at the higher temperatures. In the field mated pairs were taken in streams of 10° C and 11° C. Although the water in the tanks was only about 10 cm. deep the males never came to the surface but crawled along on the bottom, moving the diagonally opposite legs in unison. Some searching males were found to carry the cloacal appendage directed forward under the abdomen and one male taken in the field June 19, had the appendage similarly directed. A few of the males received in the laboratory between July 1 and 9 would seize any frog they chanced to come in contact with during this crawl about the tank. If the seized frog was a male it was invariably released within a short time whether or not it struggled. If the captured individual was a female an effort was made to improve the grip. Usually a limb was the first part of the frog seized, and the male placed himself at right angles to the long axis of the female. The efforts of the male are apparently directed toward throwing the female on her back. In this position she falls into a state of tonic immobility, permitting the male to readily secure a body grip. We have never seen more than one male at a time embracing a female but in both field and laboratory males have been seen to struggle for hours to gain a proper position. When females were held until the males secured a pelvic grip the latter usually succeeded in maintaining the hold for long periods. Males which gripped in the mid-body region either slipped back to the pelvic region or were dislodged. A male which secured a pectoral grip was soon thrown forward over the female. A female thrown on her back usually remains quiet for a few minutes whether or not the male continues his attentions. In one case a submerged female remained on her back with limbs flexed for twenty-two minutes after the male had left her (water temperature 4.5° C.). In the field mating pairs have been kept under observation for twenty-nine hours. Further, most mated pairs were

[1] Amer. Mus. Novitates, No. 165: 17.
[2] The Biology of the Amphibia, fig. 154 C.
[3] Copeia, 1931: 62-63.
[4] The Biology of the Amphibia, fig. 65 A.

first observed near noon and presumably some had been struggling since the previous evening for *Ascaphus* does not move about until nightfall. From both direct and indirect evidence it appears that the struggle to secure the pelvic grip is a long one and obviously the tonic immobility induced by the male hastens a successful conclusion.

It is assumed that mating usually occurs in the water because all mated pairs secured in nature were found there. One male kept on damp moss at low temperatures in the laboratory secured a pelvic grip and had its cloacal appendage thrust forward when first observed. Males which embrace in the water may or may not have the appendage in this position. There appears to be no relation between vigor of the grip and position of the appendage. Once the structure is carried forward it is usually held in the position for a considerable period.

Although the appendage may be carried between the legs of the female while the male is adjusting his grip it is eventually thrust into the cloaca of the female who in feebly attempting to escape brings her thighs together squeezing the appendage dorsally. The forward position of the structure is maintained by two postpubal cartilages found in no other Salientia. The organ is strengthened by two pairs of vascular pads extending the long axis of the structure under the skin on its ventral surface. These are apparently homologous to the corpora cavernosa of the penis of higher vertebrates. The appendage differs from a reptilian penis in that the vascular pads are not everted from the cloacal orifice but serve merely to strengthen the tubular extension of the cloaca. The ventral surface of the appendage of the breeding male is usually rendered pink by underlying pads. These structures may be rapidly emptied of the blood. A male thrown into tonic immobility was found to lose the rosy tint of its ventral surface in less than two minutes. When the vascular system of the male *Ascaphus* is injected with a suitable medium the appendage can be greatly dilated, exposing the spines within the cloacal orifice. During copulation the appendage has never this form but remains narrow with a point formed by the tip and not by the spines of the orifice.

Since the male with his appendage thrust within the cloaca of the female remains passive, the spines cannot serve as stimulating organs. It is possible that they assist the male in maintaining his position in much the same manner as the spines on the hemipenis of a snake function. The female, unlike the male, has a series of small black spines scattered over the thighs, and most numerous on their posterior surfaces. These may assist the male in maintaining his grip on the female but they would also tend to prevent the male appendage slipping down between the female's legs once it has been directed toward her cloaca.

The male in securing his grip with the forelimbs brings his fists close together under the female's body. On several occasions both in the field and in the laboratory, the hands have been found to be clasped. One male, which mated twice in the laboratory, even to the point of inserting his appendage into the female's cloaca, clasped his hands, interdigitating the fingers both times. The clasped hands were forced so vigorously into the left side of the female's abdomen that the viscera were squeezed to the

right and the fists secured a firm support against the ventral surface of the sacrum. The arms of the breeding male are very much more muscular than those of the female. The integument covering the prepollex is swollen into a pad and this, as well as the inner surface of the two inner fingers and an ovate pad on the inner side of the forearm are covered with black spines. Further, a series of very small black spines are found along the edge of the lower jaw and on the chest opposite the prepollex when the arm is flexed. In spite of this array of secondary sex characters the embrace of the male *Ascaphus* is much less vigorous than in many species of *Rana* and *Bufo*.

By means of implanting fresh anterior pituitary substance of various Amphibia into the female *Ascaphus* we have been able to induce the latter to lay its eggs in the laboratory. The method is known to induce both frogs and salamanders to lay normal eggs out of season. A female which laid July 1, deposited thirty-six eggs, another laying July 8 produced twenty-eight. Three others laying in August included masses of forty-seven, thirty-eight and thirty-four eggs respectively. Most of these eggs developed normally. The freshly laid egg with its capsules measured 4.5 mm., the egg alone 4 mm. Each egg is surrounded by two capsules and a very thin vitelline membrane. The outer capsule is very adhesive and the eggs often stick together in rods or clumps. There is no enveloping membrane as in *Liopelma* (Archey, 1922[5]) but each egg is stuck to an adjacent one by its outer capsule. If the eggs are widely spaced a gelatinous stalk may be present binding the eggs into a tangled chain and this is apparently the more usual condition in nature (Gaige, 1920[6]). The eggs also stick to the rocks or to any other surface with which they come in contact. The female is provided with a small cloacal appendage and an egg, on being laid, is directed downward because the cloacal orifice is on the ventral surface of the structure.

The eggs at the time of laying show no evidence of cleavage. Under high binocular powers spermatozoa may be seen in the egg capsules. These are not to be confused with fine threads of whitish material extending part way around the inner capsule. Development proceeds slowly, the larva not hatching until a month after the egg is laid. At this time the larva measures approximately 13.5 mm. in total length, 5.5 mm. in head and body length. The eyes are well pigmented but the head and body have only a slight tinge of grey on their dorsal surfaces. No external gills ever appear, the branchial arches being covered over by the opercular fold of each side while they are still devoid of gill tufts. A conspicuous adhesive organ develops very early. This has the form of an A with apex directed forward. The edges of the structure are raised, the organ assuming the form of a furrow except at the apex which is round and blunt. The inner surface of the groove and the ventral surface of the rounded apex are covered with hypertrophied secretory cells interspaced with numerous ciliated ones. The lateral and medial surfaces of the raised edges

[5] Rec. Canterbury Mus., 2: 65.
[6] Occ. Papers Mus. Zool., Univ. Mich., No. 8: 6.

of the organ lack these cells entirely. The mouth develops the enlarged lips, characteristic of the larva, before any teeth appear.

The tadpole at the time of hatching holds to the bottom of the dish by its adhesive organ and not by its mouth which, although large, is not equipped with horny teeth. In nature the tadpole spends at least one winter in the stream after hatching. On August 3 and 31, when metamorphosing tadpoles were found in the stream, another series from 17 to 20 mm. in total length were found in the same streams. From our observations on the slow rate of development the smaller larvae were presumably hatched during the current summer while the metamorphosing larvae were at least a year old.

One habit of the tadpole deserves especial mention. Several times in the field tadpoles were observed to climb 10 to 20 cm. out of the water. In moving on land the tadpole hitched itself along by means of its suctorial mouth. The rocks on which it climbed were usually covered with moss and algae and it seems possible that this might be a method of securing richer food than could be obtained from the swift waters of the stream. Tadpoles in the laboratory frequently climb a few centimeters out of water if the side of the container is moistened. It has previously been noticed that particles the same size as those in the stomach may be taken in through the nostrils (Noble, 1927[1]). Hence, if the tadpoles actually feed out of the water they probably have also other methods of securing nutriment.

To summarize, it may be emphasized that various features in the life history of *Ascaphus* are indicative of its basal position among the Salientia. Chief of those discussed above are the pelvic grip of the male, the single median adhesive organ of the larva. On the other hand *Ascaphus* is highly modified for life in cold running water. It is active at low temperatures. The larva can secure enough oxygen to get along without external gills and these never develop. Lungs, functioning as hydrostatic organs, are reduced as in the case of many other mountain brook Amphibia. The mating habits of *Ascaphus* seem an adaptation to life in swift noisy waters. Voice has been given up, a method of internal fertilization developed. The cloacal appendage of *Ascaphus* may be considered a forerunner of the penis of reptiles for corpora cavernosa lying in the ventral wall of the cloaca form a large part of the structure. The mating of *Ascaphus* is also of interest in that the male attempts to induce tonic immobility in the female. Adult *Ascaphus* is most active at night and on cool, damp days may leave the vicinity of streams. However, the species is abundant only in or near cool, rocky streams. Fish enemies, especially trout, tend to restrict *Ascaphus* to the smaller mountain brooks.

AMERICAN MUSEUM OF NATURAL HISTORY, NEW YORK CITY, and PULLMAN, WASHINGTON.

[1] Ann. N. Y. Acad. Sci., 30: 65.

Observations on the Early Breeding Habits of *Ambystoma jeffersonianum* in Central Pennsylvania

By Charles E. Mohr

Piersol (1907) was the first to describe the spawn of *Ambystoma jeffersonianum,* showing that the egg-masses can readily be distinguished from those of *A. maculatum.* Smith (1911) compared the eggs of the two preceding species and those of *A. tigrinum.*

Noble (1927), in considering the relation of breeding habits to phylogeny, states that both Allen and Bishop noted the males embracing the females. The reference is probably an error and should read, Wright and Allen. No one, however, has heretofore described the spermatophores of *A. jeffersonianum.* Smith (1911) considered the extremely early spawning season suggestive of an autumnal fertilization, while Piersol (1929), noticing that both sexes hide on land near the ponds during the day, suggested the likelihood of a terrestrial mating.

In a previous paper (1930) the writer has reported field observations of seven embracing pairs of salamanders and the discovery of a well-formed spermatophore in the cloaca of a male *A. jeffersonianum,* examined in the laboratory last year. No description of the spermatophore was given in that paper.

During the present season observations have been made every night for a period of ten days after the appearance of the first *A. jeffersonianum,* and trips have been made to the ponds at frequent intervals since that time. The only mountain ponds which are readily accessible are near Woodward, Centre County, at an altitude of 1475 feet, and nearly thirty miles to the west of Bucknell University, Lewisburg, Pennsylvania, where the writer was located.

The first individuals of *A. jeffersonianum,* in 1931, were seen on the night of March 25. At this time a spermatophore, believed to have been deposited by this species, was found attached to a broken twig in about three inches of water close to the edge of the pond. About a dozen of the fifty odd salamanders seen were collected. On transferring them to an aquarium the next morning, two spermatophores were found in the collecting can.

The next trip was made primarily to hunt spermatophores and an hour's intensive search revealed thirteen. On returning to the laboratory it was found that the salamanders collected on the first night had deposited five spermatophores in the aquarium.

On the third night, March 27, fully twenty-five spermatophores were located in a second pond. On this night the first eggs were seen, and three females were observed in the process of egg-laying. The fact that no *A. maculatum* reached the ponds until the following night, March 28, as

well as the fact that spermatophores were deposited in the laboratory, left little doubt as to their identity. Positive proof, however, was obtained on the second night, when a male of *A. jeffersonianum* was observed depositing a spermatophore.

The structure of the spermatophores was distinctive to such a degree that after the appearance of *A. maculatum* the spermatophores of the two species could be separated. Their distribution in the pond also was distinctive since they were deposited singly,—in one instance three were noted within a foot of each other,—in water ranging from one to three inches in depth, and attached to twigs, leaves, grass, stones, and even to the sawdust that covered the bottom of one pond. It is a well-known fact that the spermatophores of *A. maculatum* are normally deposited in groups of from ten to a hundred or more.

Fig. 1. Spermatophore of *Ambystoma maculatum*, x4.

Fig. 2. Spermatophore of *Ambystoma jeffersonianum*, x4.

The spermatophore itself resembles that of *A. maculatum* in having a gelatinous stalk surmounted by a white sac containing spermatozoa. The spermatophores of the two species are distinguishable by color and by form. In *A. maculatum* (Fig. 1) the white seminal fluid, in addition to coloring the sperm capsule, covers most of the gelatinous stalk, while in *A. jeffersonianum* (Fig. 2) only the capsule is white. This coloration accounts for the fact that the spermatophores of the latter species are quite inconspicuous. The spermatophores of *A. jeffersonianum* are slightly smaller and more slender than those of *A. maculatum*. Measurements, in millimeters, of the spermatophores of each species:

	Total height	Diameter at base of stalk	Diameter at neck of stalk	Greatest width of sperm sac
A. maculatum	7	7.5	2.5	2.5
A. jeffersonianum	5.5	7	1.5	2

The narrowness of the neck of the stalk of spermatophores of *A. jeffersonianum* was found to be a good character in identification.

As already mentioned, stages in the courtship of *A. jeffersonianum* were observed last year when seven embracing pairs were found. On the first night of the present season similar behavior was noted. In each case the male was on the back of the female, grasping her just behind the forelimbs and rubbing the top and sides of her head with his snout. All the time the male was undulating his tail. When in courtship the salamanders were but little disturbed by the rays of the flashlight, moving gradually into deeper water. Several such pairs were taken without separating the salamanders.

Another stage in the courtship was observed during the second night. Individual males,—it was usually possible to distinguish between the sexes at sight,—particularly avoided the light. One male, however, appeared not to be disturbed by the light and upon closer observation was seen to be vigorously undulating his tail and whole posterior part of his body. Several times he clutched convulsively at the ground with his hind legs. A female approached, nosing the cloacal region of the male, which almost immediately deposited a spermatophore. The male crawled very slowly away, undulating his tail feebly. The female followed and came to rest with the cloaca immediately above the spermatophore and remained motionless for perhaps fifteen seconds, then pushed slowly after the male into deeper water. The spermatophore appeared intact; probably relatively few of the spermatozoa enter the cloaca.

Another observation was made at night in the laboratory. A male swam over a female, grasping her with his forelegs, then slid slowly backward and forward rubbing his cloacal region over the dorsal pelvic region of the female. They were disturbed and separated.

The conclusion drawn from this study is that there is no marked difference in the courtship behavior of *A. maculatum* and *A. jeffersonianum*. Accordingly, the significance of the economy of spermatophore production in the latter species is yet to be determined.

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Reading Public Museum and Art Gallery, Reading, Pennsylvania.

An Interpretation of Certain Experimental and Observational Data on the Limbless Lizard, *Anniella pulchra* Gray

By Charles E. Burt

THROUGH the generosity of Mr. Charles M. Bogert of Los Angeles, I recently received a "silvery footless lizard,"[1] *Anniella pulchra* Gray,[2] which was collected on June 8, 1930, at Encinitas, a coastal town in San Diego County, California. Upon its arrival at noon on June 14 the lizard was found to be very shy and nervous. I immediately dropped it into a large dish which contained damp moss on one side and perfectly dry sand on the other. Although the creature took refuge in the moss at first, it was found to be buried in the sand by late in the afternoon. At this time I removed the moss and replaced it with moist sand, so that the lizard might have its choice of either a moist or a dry shelter. Only a few hours later I returned to the scene to find that the *Anniella* had crossed from the dry to the moist area; and here it preferred to stay, as revealed by repeated observations made at irregular times during the following two weeks.[3] This positive reaction of my lone representative of *Anniella* to an increased moisture content in the sand leads me to attempt to formulate a practical interpretation of its significance—a task which calls at once for a review of the known facts pertaining to the general ecology of the form.

Unfortunately, very little has been published concerning the habitat and habits of *Anniella pulchra*. It has been reported from various localities along the coastal strip of central and southern California and northern Lower California. Coe and Kunkel (Trans. Connecticut Acad. Sci., vol. 12, 1906: 1-55), before presenting their interesting account of certain phases of the anatomy, concluded, in a general way, that the species is "widely distributed in central and southern California, where it prefers dry, barren localities and deserts," but afterwards mentioned the *specific* habitat at Pacific Grove as "the sand dunes of the seashore" where it occurs "beneath small clusters of low bushes and under driftwood." According to Van Denburgh (1922: 467) the habits of *Anniella pulchra* are "the same as" those of its colorational variant, *Anniella nigra*. The latter entity burrows in the soil of the pine forests and sand dunes, travels rapidly under the surface of the loose soil, and is especially abundant under the lupine bushes (p. 470). It will be noted at this point that these authors have failed to mention moisture as a possible factor in determining the

[1] This name was supplied by Van Denburgh (1922, p. 465) in his monographic study of the "Lizards of Western North America."

[2] This living specimen has a body length of 100 mm., a tail length of 65 mm., and a head width of 4 mm. It is silvery in the region above a conspicuous pair of narrow, black, dorso-lateral lines, which extend along the body and tail, and yellowish below. The sides of the head, the chin, the gular region, the median ventral part of the body, and the preanal region are deep purple. A very thin, relatively inconspicuous, dark, vertebral line is present.

[3] It may be noted here that this interesting lizard always burrowed rapidly when touched, going through the sand with perfect ease.

range of *Anniella,* although all have called attention to the sandy nature of the habitat selected. In view of this it is interesting to note that Mr. Bogert found the individual now in my possession in the "moderately moist sand beneath a pastboard box." He states that "along the San Diego coast where it was collected there is a sufficiently heavy fog each night to keep the sand from drying out and to support a growth of succulent 'ice plants'." Then, in addition, Mr. L. M. Klauber has recently written to me as follows: "With reference to *Anniella pulchra,* I think that your conclusion as to the moist character of the sand is probably correct, for the species in this area (southern California) is certainly more prevalent where the sand is moist than where it is dry. It is quite common along the beach where the sand must be decidedly salt, and of course moist. Inland, I have only taken it as far as Jacumba, which is the approximate limit of the distribution of a number of Upper Sonoran species. I do not recall at this time a single desert record. All of this tends to verify your conclusions."

Thus, from the dual standpoint of observational data taken in the field and experimental data obtained in the laboratory, it appears that the silvery footless lizard *normally selects a moist, sandy habitat.* Obviously, when other conditions are equal, this is most likely to exist along a sea coast or at the margin of a large lake. With attempted inland migration *Anniella pulchra* probably becomes restricted whenever the supply of sand diminishes to a great extent, or whenever the total annual precipitation falls off to a noticeable degree; and there are, no doubt, still other factors which combine to limit its landward distribution. One of these appears to be the rise in mean annual temperature, which in itself directly lessens the amount of moisture in the sand.

SOUTHWESTERN COLLEGE, WINFIELD, KANSAS.

The Herpetological Fauna of the Americas[1]

By EMMETT REID DUNN

THE work of a number of years on the herpetological fauna of Central America, under the auspices of the Museum of Comparative Zoology and the John Simon Guggenheim Memorial Foundation, has led me to the conclusion that a large part of this fauna, usually called Neotropical, is by no means of South American origin. Instead much of it is of northern origin, and a portion of an old, worldwide northern fauna, which has had a history of southern movement, extinction, fragmentation, and restriction to the southern fringes of the "Holarctic" region in both America and the Old World.

In order to present this situation in bare outline, it is necessary to consider, however briefly and inadequately, the whole herpetological fauna of the Americas.

Before doing this it may be well to glance at the well-authenticated history of the mammalian fauna of the Americas. The outline of this has

[1] Contributions from the Department of Biology, Haverford College, No. 9. Read at the 1931 meeting of the Society.

long since been blocked out, agrees sufficiently with the present distribution and the paleontological facts, and is generally accepted.

This history indicates a connection of the two continents in the interval between Mesozoic and Tertiary, and in Paleocene times; a long period of separation and isolation (Eocene-Miocene, as the first indications of North American mammals in South America and vice versa is in Pliocene deposits); resumption of connection toward the end of the Miocene. This is well borne out by the geological fact that much of Central America represents a geoanticline of middle Tertiary limestone of marine origin, somewhat overlaid by more recent vulcanism.

Also, the mammalian situation shows a northern (Boreal) fauna, practically identical with that of Europe and North Asia; a more southern, older, endemic fauna (Sonoran), largely peculiar to North America, but showing resemblances to the fauna of Southern Europe and South Asia (this appears in South America in the Pliocene); a distinctively South American element, with some resemblances to elements in Australia and Africa (this appears in North America in the Pliocene).

The principles of Matthew (northern origin and southward dispersal) fit the facts of the mammalian situation so well, that we might well attempt to seek some explanation of the herpetological fauna in his terms. Such an attempt as the one that follows is not to be taken as dogmatic or final, but it is hoped that certain lines of research may be indicated (indeed any plan is better than none), and the demolition of some of the ideas hereinafter to be promulgated may result in the advance of our knowledge.

If there is truth in the mammalian scheme, we might expect to find among the manifold elements of our American reptiles and amphibians the following groups:

1. A northern, circumpolar, modern element. This would be truly *Holarctic.*
2. A more southern, older element, which I shall call *Old Northern.* The Old World analogues of these creatures are to be sought in the southern fringes of the Palearctic, or in the African or Oriental regions. This series may be subdivided into:
   a. A more primitive southeastern and Central American fauna with affinities as above.
   b. A more modern southwestern arid fauna, strictly American.
3. A still more southern, still older element, the original fauna of South America, with its analogues in the Australian or Ethiopian regions. This I shall call *South American,* as I wish to avoid the term Neotropical for the present.

A too strict agreement between the herpetology and the mammalogy is not to be expected because:

1. The fossil evidence is by no means so strong, as few reptiles or amphibians make good fossils.
2. The herpetological fauna is to be expected to be very weak in modern, Boreal elements, as reptiles and amphibians cannot stand the cold.

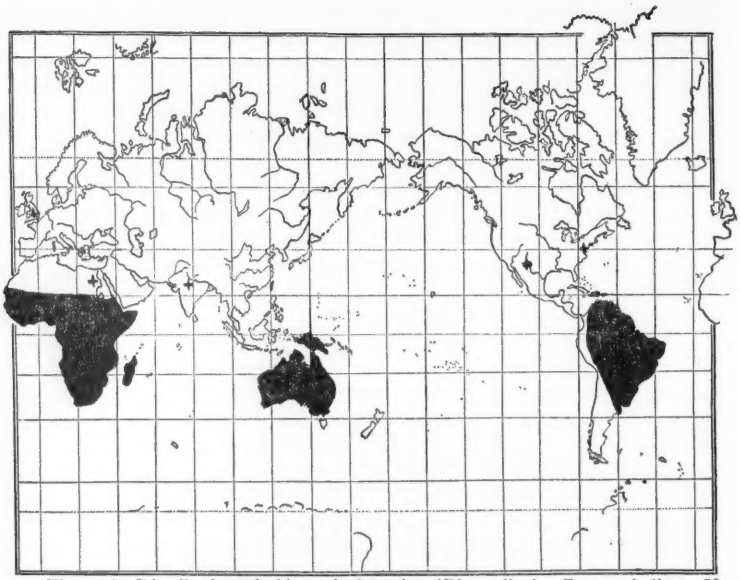


Figure 1. Distribution of side-necked turtles (Pleurodira). Crosses indicate Upper Cretaceous and Eocene fossils.

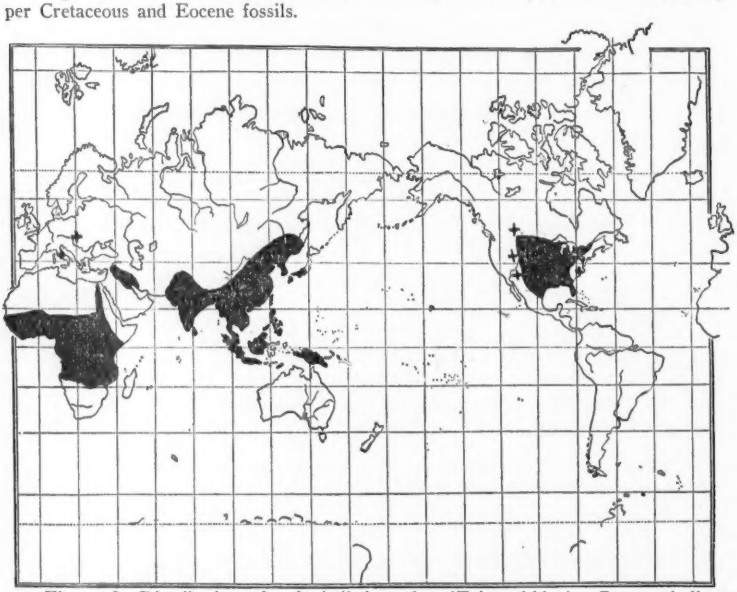


Figure 2. Distribution of soft-shelled turtles (Trionychidae). Crosses indicate fossil finds.

3. Some of the groups may be vastly older than mammalian groups, and hence not subject to the same interpretations.
4. Some of them may be vastly more subject to accidents of transportation, extinction and survival than any mammals.

Considering these provisos, the agreement to be found is quite surprising.

Rather than follow strict systematic order, I begin with the turtles, as the paleontological history is far better than for the other groups. I follow Hay's analysis of the groups.

The side-necked turtles, the Pleurodira, with the families Pelomedusidae and Chelyidae, are at present restricted to South America, Africa and Madagascar, Australia and New Guinea. They are known from Upper Cretaceous deposits in North America, but not thereafter, while they are found in Eocene deposits in Europe and in India, but not later. In America they are a perfect example of a South American group, whose affinities are Australian and African, and whose range is explicable by their former widespread presence in the northern hemisphere.

Among the Cryptodira, several families seem to have had slightly different histories. Hay considers the Dermatemydidae as primitive. They are now restricted to southern Mexico and the more northern countries of Central America. They are known as fossils from European Eocene and Oligocene and from Cretaceous to Oligocene in the United States.

An ally and possible descendant is the family Carettochelidae of New Guinea.

Another ally and descendant is the American family Kinosternidae, distributed from the eastern United States to northern South America, with no fossil history.

The Chelydridae, again eastern United States to northern South America, with *Devisia* in New Guinea, are known as fossil from European Oligocene and Miocene and American Miocene.

These three families may well be taken as representatives of an Old Northern fauna, largely persistent in the southeastern and more humid portions of the United States and Central America, entering South America only slightly, and by no means a "Neotropical" group.

The Trionychidae likewise may fit in here, although they have never entered the boundaries of the Neotropical region, as their Old World distribution carries them well south into Africa and the Orient. They are Cretaceous to recent in North America.

The Testudinidae have entered South America to a considerable distance. They reached the Galapagos and the West Indies, but I doubt very much if they were present in South America during the period of its isolation, as they are such frequent fossils in Eocene to recent deposits in the United States. They are rather obviously dying out now in the northern parts of the world.

The Emydidae contain genera of rather different zoogeographical value.

Geoemyda is restricted to the Neotropical region, from Mexico to northern South America, but its South American differentiation is slight,

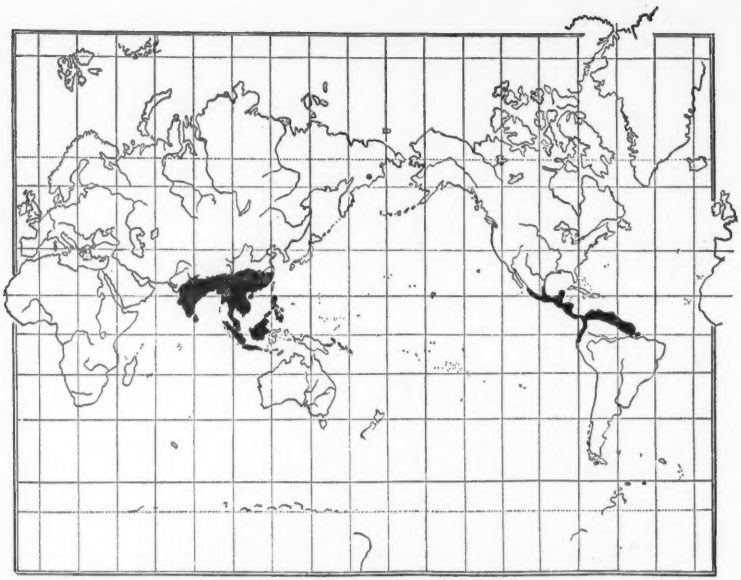


Figure 3. Distribution of turtles of the genus *Geoemyda*.

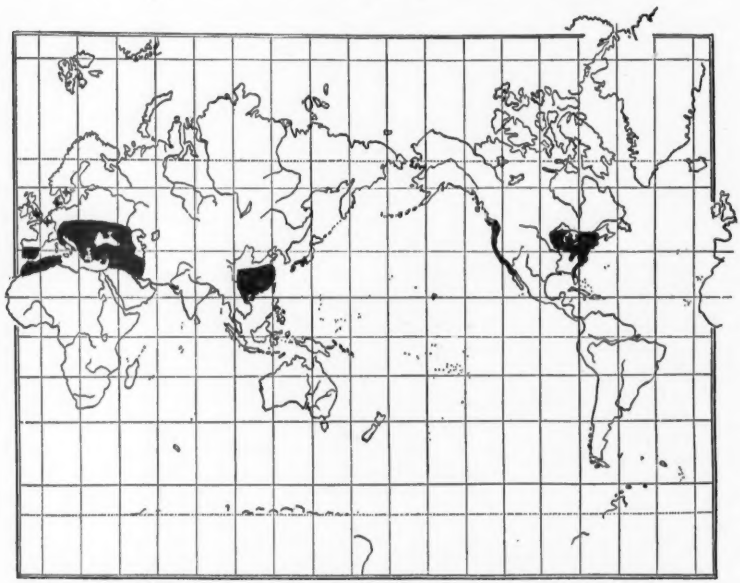


Figure 4. Distribution of turtles of the genera *Clemmys* and *Emys*. Crosses indicate Tertiary fossils.

and its presence in southeastern Asia suggests that it belongs to the middle fauna. Here also may belong *Pseudemys,* which reaches South America to the same extent and has colonized the Greater Antilles. Most of the other American genera are restricted to the southeastern United States, with the exception of *Clemmys* and *Emys,* which scarcely enter the southeast, and which are both found in the northern parts of the Old World. I suggest that these two genera belong to the newest element in our fauna, the "Holarctic" modern group.

Emys itself has an interesting distribution in this country, to which more attention should be paid. It occurs in the extreme eastern portion of New England, where it is not uncommon, but there is a great gap in the range, as it does not crop up again until western Ohio, save for a few records from Pennsylvania. Apparently two, or three, colonies have survived glacial times. It has apparently never been taken in western New England or in New York.

Our turtles then, fit rather nicely into three groups.

1. The Pleurodira, very old Northerners or South Americans, the only turtles of South America during its mid-Tertiary period of isolation.
2. The great majority of our forms, Old Northerners or mid-Tertiary "Holarctic," now much broken in range, to some degree entrants into South America, and surviving here and there.
3. *Emys* and *Clemmys,* which scarcely enter the great turtle areas of southeastern United States and Central America.

I have dealt with the turtles first, as the fossil evidence is much more nearly complete. With the remaining groups it is quite fragmentary, and while their distribution is not inconsistent with that of the turtles, their disposal is not so well determined.

The Apoda, or caecilians, are a small tropicopolitan group. I have recently made a special study of the American species. I conclude that none are congeneric with any Old World forms. The American species comprise at least four genera and at most six. Only one of these occurs north of Panama, and only two reach that country. No species occurs outside of the traditional "Neotropical" region. We may consider the Apoda as primarily South American as far as the Americas are concerned, and their spread northward as having occurred since the connection was resumed.

The Caudata scarcely enter the southern parts of the world. In America few occur south of the traditional boundary save *Oedipus.* These we can readily attribute to southward spread since the connection was resumed.

But among the present inhabitants of North America I think we can distinguish an older and a younger group. Those families which are restricted to North America (the Sirenidae, the Ambystomidae, the Amphiumidae) I believe we can consider older types, corresponding to the Dermatemydidae, or to the Kinosternidae.

Our Plethodontidae, Proteidae, and Cryptobranchidae, which we share somewhat with the Old World, I think can likewise be considered as members of an older fauna. More especially, since Cryptobranchidae are known

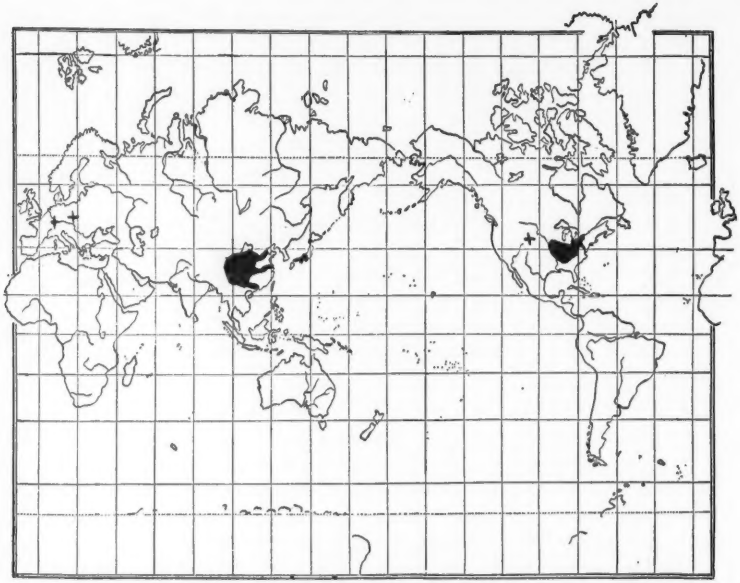


Figure 5. Distribution of the salamanders of the family Cryptobranchidae. Crosses indicate Mid-Tertiary fossils.

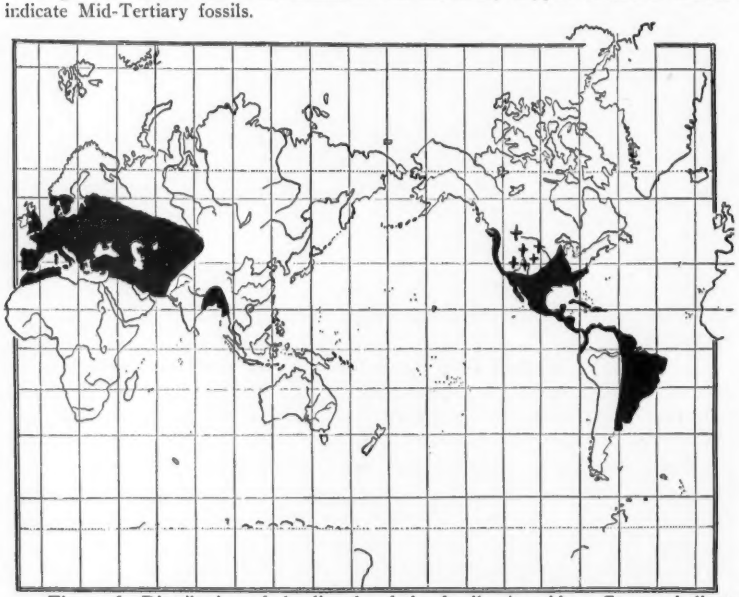


Figure 6. Distribution of the lizards of the family Anguidae. Crosses indicate Eocene-Oligocene fossils.

as European mid-Tertiary fossils, and (as *Plicagnathus*) in the Pliocene in Nebraska.

As possible more recent types in America I would suggest *Triturus,* the west coast species of which is plainly allied to the Asiatic members of the genus, and the eastern ones allied to the European. However, *Triturus* reaches Tampico, Mexico.

The Salientia are a vastly more difficult group to treat, and I remark upon them with considerable diffidence.

The more primitive families are not well represented anywhere, and show very peculiar distributions. Yet I think there will be no cavil if the Pipidae are allocated as South American, and the Pelobatidae and Liopelmidae as North American. Presumably the Liopelmidae may belong to the older group, and quite likely the Pelobatidae also.

I am inclined, with Kellogg, to regard *Rhinophrynus* as so different from anything else as to represent a distinct family, which then may be regarded as old North American.

The modern "Bufonidae," which includes the old "Leptodactylidae," is, from a zoogeographic point of view, better treated under the older arrangement.

Bufo itself is almost worldwide. The other genera belong to the old "Leptodactylidae," and number not less than 25 South American genera. Only five of these enter Central America, only three extend to Mexico, and only one is present on the Mexican Plateau (in the "Nearctic" region), where it has given rise to two endemic genera. Two genera are in the southern United States. Two of the genera common to South and Central America occur in the West Indies.

If this group, enlarged to include *Bufo* and *Rhinophrynus,* be considered as a whole, its distribution is very difficult to explain.

Bufo has undergone considerable differentiation in South America, but no more than many a Northern mammalian group. The interrelationships of the various species of *Bufo* are obscure, and perhaps it is best to regard it with *Rhinophrynus* as Old North American, and the remainder of the forms as Old South American.

The Brachycephalidae, which agree with the Bufonidae save in the fusion of the halves of the shoulder girdle, are not a natural group, as Noble has shown. The various groups of this "family" of ten genera have arisen separately from different Bufonid genera. Thus they should properly be treated in connection with the family from which they have arisen. Of the ten genera only four enter Central America, and none of these occur further north than Nicaragua. They are obviously an element in the indigenous fauna of South America. One is present in Cuba, but in spite of its having received considerable attention, its relationships are still questionable. The Cuban species may stem from a Cuban bufonid, or it may be a separate entrant from a South American stock.

The Hylidae in South America number at least 13 genera. Not more than six of these reach Central America, where two more are endemic. *Hyla* is in the Antilles, and in the United States, where it has produced two endemic daughter genera. The group is known from a few species in the

Palearctic region (probably allied to North American types), and a considerable number of species in the Australian region. All outside of America belong to the genus *Hyla.*

I am inclined to regard *Hyla* as the reverse of *Bufo,* and to be (with its allies) an indigenous element of the South American fauna, which has moved into North America, and even further on into Europe and Asia.

Bufo would appear an indigenous Northerner which has widely invaded the southern parts of the world, but not Australia.

I must say that this disposition of *Hyla* is none too satisfactory, since no mammalian parallels are known, the porcupine of the North Woods being the most northern extension of a South American mammal known to me, and it may be that both *Hyla* and *Bufo* had their generic ranges divided by the early Tertiary break between North and South America. Yet if this were true, it should be possible to divide both genera into northern and southern groups, which does not seem feasible at present.

The Brevicipitidae number about eight American genera, all to be found in South America. They are likewise found in southeastern Asia and on into the Australian region. Three of the eight genera reach Central America, and two of these extend through Mexico into the United States. They appear therefore to be elements of the indigenous South American fauna.

The Ranidae in America are all members of the genus *Rana.* Apparently only a single species enters South America. This species, with a few others in Central America, shows resemblances to species of southeastern Asia, and may belong to the older Northern fauna. On the other hand, the woodfrog group is so obviously similar to the *Rana temporaria* group of the northern part of the Old World that one is inclined to consider them as members of the newer Northern fauna, especially as their ranges are very northern in this hemisphere.

The crocodilians, with four American genera, show, as is natural, no boreal elements. *Alligator* is surely an element of the older Northern fauna, and *Caiman* and *Paleosuchus* as surely indigenous South American. Of *Crocodylus* I am not so sure, it comes close to being semi-marine, and with such creatures, as with the sea turtles, the question of continental connections is of no moment. It is, however, more likely to be Old Northern than South American, since mid-Tertiary fossils are known from the United States.

Among the lizards, the first family, the Gekkonidae, are the most difficult to allocate, especially because they seem particularly prone to get themselves accidentally introduced. They are a primitive group of lizards, and probably there were members of them on both sides of the North American-South American gap. Possibly those on the northern side included *Tarentola, Coleonyx,* and *Aristelliger,* none of which occur in South America. *Tarentola* occurs in southern Europe, and close allies of *Coleonyx* occur as far north as most geckoes in the Old World. In this connection, since the "Eublepharidae" have been merged with the Gekkonidae, investigation should be made as to the difference, if any, between *Aeluroscalabotes* of Malaya and *Coleonyx. Gehyra* and *Hemidactylus* were doubtless introductions during the slave trade.

The other genera, nine in number, are all found in South America. Four are likewise found in parts of the Old World, while four are strictly confined to South America, and one, *Sphaerodactylus,* is fairly wide spread in America. All nine may be considered "Neotropical"; the *Lepidoblepharis-Sphaerodactylus* group surely is.

The Iguanidae present an American distribution, with outliers in Madagascar, Fiji, the Galapagos, and the Antilles. They seem to form a natural group, and the Madagascar and Fiji representatives bespeak for them great antiquity, so that we might well posit the family as South American were it not for fossils in the Eocene of Europe and the Eocene and Oligocene of the United States. Also eleven of the 49 genera are confined to the "Nearctic." There is here a group which probably had representatives on both sides of the break, and indications are not wanting that the family may be eventually divided into a northern and a southern group. If this be done, it is worth noticing that the Madagascaran species belong with the Southern, and the Galapagos and Fiji forms with the Northern.

It is, of course, not impossible that the whole family is a reentrant into Nearctic after the connection was resumed, although the Sonoran differentiation seems too great for this.

The Teiidae are not known in any way outside the Americas. Early Tertiary fossils are known from South America. Of the approximately 30 genera, all are found in South America, eight invade Central America, three of these enter Mexico, and only one is found in the United States. I should consider this family as strictly South American.

The Xantusiidae, confined to America, reach the Antilles and Panama but not South America. I place them as Old Northerners.

The Anelytropsidae, Helodermatidae, Xenosauridae, and Aniellidae are likewise Old Northerners. *Heloderma* is fossil in northern Oligocene and its only relative, *Lanthanotus,* is from Borneo. These families cannot be properly considered as "Neotropical."

The Scincidae, which barely enter South America (one out of four genera is there present) seem also Old Northerners.

The Amphisbaenidae, widespread in South America, are yet known from mid-Tertiary northern deposits. The differentiation is about equal in north and south, and they had best be considered as members of the older northern fauna.

The Anguidae enter South America as two genera, one of which is endemic. In contradistinction, six genera do not enter South America and they are known as Eocene-Oligocene fossils in the United States. An Old Northern group, in my opinion.

The snakes are the most difficult group of all to treat. There is no general agreement as to the actual systematic relationships of the majority of the genera. There is still a widespread inclination to arrange the genera of the Colubridae as "aglyphous" and "opisthoglyphous." The results are manifestly and obviously unnatural as far as the American forms are concerned. Cope's arrangement has not been generally accepted, but it has not yet been shown to be false, and I shall follow it in this paper.

The Typhlopidae manifest four American genera. All four occur in

South America, none in the United States. They are probably South American, and the same statement applies to the Leptotyphlopidae, although these reach further north. It is possible that *Typhlops* itself may be an Old Northern genus, while the more primitive *Anomalepis* and *Helminthophis* are South American, for *Typhlops* is poorly developed in South America, but the point is not one to develop seriously as the genus is also found in Australia.

The Boidae (including the "python" *Loxocemus*) are a widespread group of antique snakes. Probably *Loxocemus* is the most primitive genus of snakes now living. Judging from the present distribution of the group in the Americas I should incline to the belief that *Loxocemus, Charina,* and *Lichanura* are Old Northern genera, and that the other seven genera are South American, an arrangement similar to that of the Iguanidae.

The Anilidae (Ilysidae), while restricted to South America, are perhaps Old Northerners, as they are not present in Africa or Australia, but are found in India.

Within the Colubridae, the Acrochordinae, with the single American genus *Nothopsis,* whose relatives are Indo-Malayan, may be Old Northerners.

This applies also to the Sibynophiinae, whose American range is Mexico to Panama, and which also occur in the Oriental region and Madagascar.

The Natricinae, which extend only to Costa Rica, are pretty certainly Old Northerners.

The reverse is probably true of the Ophiinae, and of their offshoot group the American Dipsadinae (if this be recognized). These, with some 64 genera, are almost entirely South American. Seven genera, four of them endemic, occur in the United States. Seven genera are endemic in Central America and four in the West Indies. Only sixteen out of the 64 do not occur in South America.

The Colubrinae are again Old Northerners. I count 39 American genera. Two are endemic to South America, and 17 are found there. Six are confined to the United States, and 22 are found there.

The Micruridae I should incline to regard as South American despite Schmidt's recent allocation of *euryxanthus* as the most primitive species.

The Crotalidae, on the other hand, seem to me Old Northerners despite the numerous species in South America. The differentiation of *Bothrops* is greater in Central America than in South. No good reasons have yet been adduced for separating it generically from its Oriental ally *Trimeresurus. Agkistrodon* is certainly an Old Northern genus, illustrating beautifully the faunistic relations between southeastern United States, Central America, and the Oriental region, while *Crotalus* is obviously a development of the newer arid branch of the older Northern fauna (as is *Thamnophis*).

On this basis the South American region had, during the period of separation: Apoda; Pipidae, Leptodactylidae (but not *Bufo*), Brachycephalidae, Hylidae, and Brevicipitidae among Amphibians. Among Reptiles: pleurodire turtles, the caimans, Gekkonidae, Iguanidae, Teiidae, Typhlopidae, Leptotyphlopidae, Boidae and Ophiinae. This is a slim list

considering the number of groups now termed "Neotropical." But comparison with better known mammalian groups assures us that (a) many present day "Neotropical" mammals are relatively recent immigrants from the north, and (b) that there has been widespread extermination of many peculiar indigenous South American groups. It may well have been so with reptiles and amphibians, but of course we lack the fossil evidence in these groups.

The elements to be considered Boreal are: *Triturus* (possibly); the *Rana sylvatica* group; turtles of the genera *Emys* and *Clemmys;* possibly *Liopeltis* among the snakes. This is a very small group, but other cases of generic identity with the Old World in herpetology show so much more differentiation and such a more southern range that it is scarcely safe to suggest them as members of a newer Holarctic radiation.

All other groups may be suggested as mid-Tertiary "Holarctic," or Old Northern in origin. Considerable differentiation has, of course, arisen in this lot, so that genera or even small families may be endemic to America.

The relationships of the Greater Antillean fauna have usually been termed Neotropical, and the animals are supposed to have entered from Central America. But, if the foregoing remarks be acceptable, the fauna of these islands, while derived from Central America, is by no means entirely of South American derivation. There is actually a majority of Old Northern types (Xantusiidae, Scincidae, Emydidae, Anguidae, etc.), together with a number of strictly South American types (Hylidae, Teiidae, etc.). This indicates a derivation of the fauna at a time when the process of mixture was well under way, after the resumption of the connection, and hence Pliocene at earliest. Those elements which are most assuredly South American (Pipidae, Apoda, Pleurodira, caimans, etc.) are absent from the Greater Antilles.

Central America and the Greater Antilles then take on the aspect of a debatable ground, populated in part by true South American derivatives, and in part by North American derivatives which have become extinct in most of North America. The boundary between the Neotropical and the Nearctic thus becomes an expression of the escarpment of the Mexican plateau as the most important physiographic barrier in the region, rather than a true line of division between faunae of different origin.

That this picture, while much less simple than the classical one, is yet far more true, I feel confident. We are accustomed to regard our northern porcupines and our recently extinct ground sloths as of South American origin; surely our species of *Heterodon* and *Diadophis,* and our southeastern species of *Liophis* and *Anolis* are similar cases. Likewise the Ungulata and Carnivora of South America are demonstrably of post-Miocene northern origin, and we should not be surprised at the presence in South America of a few endemic genera of snakes of northern origin. In support of the Old Northern Holarctic fauna, I might adduce the undoubted presence in this country of Tertiary gavials, tomistomas and varanid lizards, now strictly Old World.

In conclusion, I admit that I have spoken of the South American fauna of the early Tertiary (before resumption of connections) as derived from the north.

This is an assumption unnecessary to the argument of the present paper, since it is immaterial to *this* whence came the true South American creatures. None the less, I should like to point out a few facts which bear on a much discussed problem, that of southern connection between southern continents, the Gondwanaland or Antarctica connections. Herpetologists deal with a variety of creatures, some of which, as turtles and crocodiles, are almost ideal material, in structure and in habits, for the production of fossils. Others, as snakes, frogs, and small salamanders, are very bad material. In this situation, it seems to me that great weight should be given to positive evidence, and very little to negative evidence.

For those groups, in herpetology and in other fields, which make good fossils, we have definite evidence for northern origin of southern groups. The dispersal of such forms has gone on quite obviously without doing violence to continental outlines, without the erection of "land bridges," without the assumed upheaval of abysmal oceanic depths. There is no need to explain the distribution of the side-neck turtles by such means. We are thoroughly acquainted with their former northern distribution and with their extinction in the north. Their appearance in the south is far more easily explained by their entering South America from North America, Africa from Europe, Australia from India, than by assuming connections between South America, Africa and Australia, and no one nowadays tries to uphold such an idea for them.

To assume different migration routes for Leptodactylidae and Pleurodira, when both have similar distributions at present, is gratuitous. We know Pleurodira to have been widespread in the north world. We do not know Leptodactylidae to have been present in the north world. Frogs are not good material for fossil making, and absence of fossil evidence means nothing one way or another. All southern groups whose fossil history is at all well known show earlier northern fossils, and demand no great changes of land surfaces to explain their distribution. Why assume a totally different history for the southern groups for which we have no fossils (and from their nature need expect none) when such a history demands extraordinary changes of land surfaces, the sole evidence for which is absence of fossils in non-fossilizing groups.

Hypothetical connections are still upheld by students of what I may term non-fossilizing groups. They are maintained in the face of proven opposite dispersal in all fossilizing groups. The reason seems to be an unwillingness to admit the possibility of widespread extinction, an unwillingness easily explainable, since in the absence of fossils, this phenomenon is not obvious in these groups. It is, however, only too obvious in other groups, and, if one notes that gavials, tomistomas, varanid lizards and pleurodire turtles were formerly present in North America, and are now extinct, and that borhyaenids and the whole diverse series of Notoungulata were formerly present in South America, and are now extinct, and giant ground sloths in both continents, and are now extinct, one need not attend too long to arguments that it is unreasonable to suppose that certain frogs and crayfishes, with their protozoan and trematode parasites, have become extinct in northern regions. Especially, when, in order to avoid the unwelcome notion of extinction (a notion which is thoroughly

proven for all large animals), one must resort to violence to the face of the earth.

Truth, in such matters, lies with the paleontologists. Students of groups which have no paleontological history would be better advised if they were to arrange hypothetical dispersal routes to conform with the routes of those groups whose paleontological history is known, whose distribution is similar, and whose dispersal routes are not hypothetical but proven.

We have at present an attempt to maintain two schemes of dispersal in explanation of a single type of distribution. One scheme, hypothetical and doing violence to the face of the earth, for small creatures of which we have no fossils; a second scheme, completely proven, agreeing with the face of the earth, for larger forms of which we have fossils.

The second scheme is compelled to admit widespread and unexplained extinction, because the fossil record shows it. The first scheme will not admit extinction because there is no fossil evidence.

I have been accused of the use of dialectic in this connection. I admit the impeachment, although I am well aware that the only valid evidence is factual. The use of dialectic is, however, pardonable, not as an argument, but as an endeavor to call attention to factual evidence otherwise ignored.

Thus far I have adopted the classical scheme of the permanence of continents and oceans. I have recently given much attention to the theory of continental flotation, proposed by Wegener, which is finding much approval among the younger geologists. While I find myself in accord with them, in so far as no other theory satisfactorily accounts for folded strata, I cannot accept nor agree with their zoology. Thus from mammalology and herpetology I can see no support for close connection between South America and Africa during the Tertiary or even the Cretaceous, and I understand from ichthyologists that their branch of the science also declines to agree. The distribution therefore of non-flying land forms supports the present configuration of the earth's surface throughout the Tertiary and back into the Mesozoic. No one whom I have consulted on the subject considers that the distribution of living forms throws any light on the arrangement of land or sea in the Permian. We therefore cannot deny the flotation theory on zoologic evidence, but on the same evidence can deny close connection between southern continents from the Cretaceous on. And indeed the whole of the Mesozoic intervenes between the similarities which they find in late Paleozoic formations on opposite sides of the Atlantic.

As far back as we can identify the genera or the families of our present fauna, it is my opinion that we will more and more find evidence of the distinctness of the present continents. We have, as zoologists, something to say about conditions so far and no farther. But what we have to say holds good into the Cretaceous, and then our present genera and families cease to appear. Beyond that date we become silent; after that date our remarks should receive attention.

HAVERFORD COLLEGE, HAVERFORD, PENNSYLVANIA.

Kinosternon flavescens: A Surprising Turtle Record from Illinois[1]

By Alvin R. Cahn

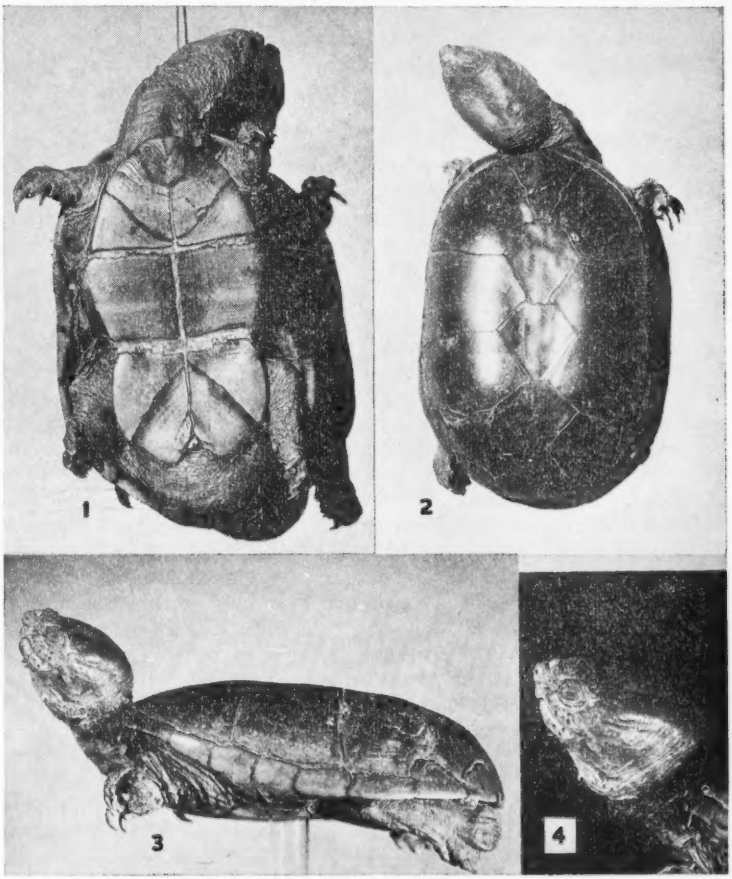
DURING June, 1927, Dr. David H. Thompson, of the Illinois State Natural History Survey, collected five specimens of what he very aptly called a "flat-backed stink pot" from Meredosia Bay of the Illinois River, Morgan County, Illinois. These were obtained from hoop nets used by fishermen to catch catfish, which type of net always yields a large number of turtles. These five specimens he recently turned over to me for identification and use in a monograph of the turtles of Illinois now in preparation, with notes to the effect that he had seen probably twenty to twenty-five additional specimens between Meredosia and Peoria—a distance of approximately 90 miles by river. As these turtles exhibited characters utterly different from any Illinois member of the family Kinosternidae, to which they obviously belonged, and as I could not place them in any key to the family which I had at my disposal, I borrowed representatives of the known species of this family from the American Museum, the United States National Museum, and from many personal friends throughout the country. From these collections it is evident that the turtle is beyond question *Kinosternon flavescens* (Agassiz).

One glance at the published distribution of this species will explain the purpose of this note. Stejneger and Barbour (1923) give its range as: "Texas, north to Kansas and Colorado, west to Arizona"; Yarrow (1882) reports it from Fort Yuma, California, Fort Union, New Mexico, and Utah; Boulenger (1889): "Arkansas, western Texas, and Gila river"; Pratt (1923): "Texas to Arizona; northward to Kansas and Colorado"; Ellis and Henderson (1913): "Arkansas to Rocky Mountains, north into Colorado"; Jordan (1929): "Kansas to Texas, Colorado and Arizona"; Siebenrock (1907): "Arkansas, Texas, Arizona"; Garman (1884), evidently quoting Yarrow: "California, Texas, Utah." And so forth. Its occurrence in a thriving condition in central Illinois is, therefore, certainly worthy of mention. Had but one specimen been captured, it might be considered as accidental or as a "transport," and as such hardly warrant serious consideration. But this is not the case. How the species wandered so far from its apparent normal range is a question I am unable to answer, but, inasmuch as all the specimens at hand from Illinois are extremely large (some larger than any specimens loaned to me), and since they have been observed over such an expanse of river, it is apparent that, whether their occurrence in Illinois be artificial or not, they are well established and thriving, and not excessively rare. Every effort will be bent toward determining whether the species is breeding in this area.

Kinosternon flavescens has certain peculiar characteristics which will,

[1] Contributions from the Zoological Laboratory of the University of Illinois No. 404.

at a glance, serve to distinguish it from all other species of the genus or family, and since the only mention I find in literature to certain of these is hidden away in Gilmore's paper (1923), where one is not likely to search for it, and in Siebenrock's German monograph (1907), which is not usually at hand—indeed, no adequate diagnosis of the species is generally available in English—a brief description of its external characters is perhaps not out of place. Agassiz (1857) has given its cranio-osteological features in detail, but nothing else.



Male *Kinosternon flavescens* from Illinois

Fig. 1. Plastron; ventral view.
Fig. 2. Carapace; dorsal view.
Fig. 3. Lateral view to show depressed carapace and enlargement of the ninth and tenth marginals.
Fig. 4. Study of the head.

Kinosternon flavescens (Agassiz)

Platythyra flavescens Agassiz, Contr. Nat. Hist. U. S., 1857, 1: 430; 2, pl. 5, figs. 12-15.

Cinosternum flavescens Cope, Bull. U. S. Nat. Mus., 1, 1875: 52.

The largest species of the family Kinosternidae found in North America, the carapace measuring up to 146 mm. in length. Shell broad, greatly depressed, flat, often even dished along the mid dorsal line of the carapace. CARAPACE: first vertebral scute triangular, the base (anterior margin) equal in length to the sides, truncate at the posterior apex. Second, third and fourth vertebral scutes roughly hexagonal, with the anterior margin greater than the posterior; fifth vertebral truncately triangular. First, second and third costal scutes very large; fourth conspicuously smaller. Marginals 22 plus the nuchal. Nuchal very small. Ninth and tenth marginals conspicuously large, triangular, the apexes contiguous, and the two scutes of equal height. Caudal marginals relatively small. This condition of the three pairs of posterior marginals is to be found in no other kinosternid. Scutes mostly smooth, with a slight tendency toward rugosity in the posterior region. PLASTRON large, similar in type to that found in the *subrubrum* group. Gular large, unpaired, its length approximately equal to the inter-humeral suture. Humerals roughly rectangular. Pectorals triangular, the inter-pectoral suture very short (*vide* Boulenger, 1889: 36, to the contrary). Abdominals nearly square, the wings grooved posteriorly. Femorals triangular, with very short inter-femoral suture, this suture approximately 1/7 of the inter-anal suture. Anals triangular, with long inter-anal suture, and with a conspicuous round-shouldered notch posteriorly. Considerable cartilaginous material is often found along the pectoral-abdominal and in the inter-abdominal sutures, and still more along the abdominal-femoral suture, the amount greater in males than in females. Axillary small; inguinal long and narrow, reaching to the seventh marginal. Head large and powerful. Top of head with a small bifurcated U-shaped nasal plate, the arms of the U following the dorsal rim of the orbit to its posterior margin. The shell of the upper jaw reaches the anterior ventral margin of the orbit, following half way up it, but does not make contact with the nasal plate, leaving a fleshy bridge between the snout and the anterior dorsal margin of the orbit. Snout pointed. Upper jaw strongly hooked, and with a prominent "first tooth." Posterior to this the profile of the jaw appears as a curved blade without any further prominent "teeth." Gular barbels prominent; second pair of barbels on the throat either inconspicuous, unilateral or absent. Neck with but a few tubercles dorso-laterally, and none ventrally. Horny scales on the wrist practically absent; inconspicuous. Claws on fore limb strong, but highly graded as to length: the outer (fifth) is very small, the fourth twice its length, the third three times its length, the second four times its length, the first (inner) like the third. Posterior claws also graded, but to a lesser extent. Tail long in male, short in female, but with a distinct terminal claw in both sexes. COLORATION: Carapace olive green, uniform, the sutures being finely edged with black, which is increasingly inconspicuous in the older

and larger specimens. This black line tends in some specimens to overlap the suture as in *K. subrubrum hippocrepis*, while in others it lies as the posterior boundary of the anterior scute, much as in *K. subrubrum subrubrum*. Plastron light in color, yellowish, with a tendency toward brown. Soft parts gray green, darker above and lighter beneath; unmarked. Sides of neck and head yellow. Head without markings of any kind. Jaws horn colored, mottled with olive. SEX DIFFERENTIATION: The typical kinosternid features hold true in this species, so far as the sexual dimorphism is concerned. The tail of the male is much longer and stronger than that of the female. Beak of upper jaw more pronounced in males than in females; male with "stridulating organs" on the inner surface of the hind legs well developed in the form of a group of small, but strong, horny tubercles, which is absent in the female. Males considerably larger than the females.

MEASUREMENTS OF KINOSTERNON FLAVESCENS IN MILLIMETERS

Locality	Meredosia, Illinois				Wood Co., Okla.		San Marcos, Texas	
Carapace: Length	146	138	128	140	132	99	112	105
Width	98	97	90	99	94	74	83	78
Plastron: Length	121	114	108	121	118	89	102	93
Width	86	79	75	83	77	60	70	60
Depth of shell	45	43	42	45	43	38	44	41
Head: Width	30	30	27	30	28	21	21	23
Tail: Length	52	49	44	49	49	19	22	34
Sex	M	M	M	M	M	F	F	M

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UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS.

Sex Determination in a Species of the Kinosternidae, with Notes on Sound Production in Reptiles

By Ralph De Sola

IN the annals of herpetology it is generally agreed that there is no mechanical sound producing apparatus in reptiles other than the rattler's rattles. However Gadow, in describing geckoes, writes:

Teratoscincus: [found in Persia]. The body is covered with imbricated, rather large and smooth scales. The tail is round at the base, compressed in its posterior half, covered below and on the sides with scales like those of the body, but on the upper side with a series of large, transverse, nail-like plates. By rubbing these plates together, this Gecko produces a shrill, cricket-like noise, ...
Ptenopus: A Gecko of Damara Land [near the Kalihari Desert in South Africa], likewise adapted to desert life, produces a similar chirping noise by its throat.

Logically, sound production includes vocal utterances and inasmuch as some investigators deny that turtles have a sense of hearing it is significant to read Darwin, Beck, Boulenger and Gadow, whose works are replete with references to the voice of the turtles and to their high degree of auditory perception.

Observers of the Galapagan species *Testudo* are unanimous in their observation that the male tortoises utter vocal sounds of great volume and intensity during the mating season, but as this mode of sound production has never been considered in the light of anatomical dissection and comparison of male and female vocal organs, the presence of voice is discarded as a dimorphic character. The brunt of criticism remains with those same investigators who assign turtles to the category of deaf and senseless creatures.

With this discussion in mind a record of a sound producing mechanism in *Kinosternon subrubrum subrubrum* (Lacépède), should prove interesting.

On April 4, 1931, at Schenectady, New York, along the south bank of the New York State Barge Canal, the love-play of this turtle was seen. Attention was directed to certain sounds that issued from the pair, which may be described as approximating notes made by crickets. The hinder limbs of the male moved in a manner new and novel as compared to the mating of other North American turtles. During the copulation the cricket-like sound continued and for closer examination both animals were snatched from the bank.

On the male, horny scales were found on each hinder leg: a pick-like scale on the femur opposed to a flat scale on the tibia. The rubbing of the two sets of scales produced a shrill sound. The female exhibited smooth scales as distinct from the horny tubercles of the male.

This observation substantiates Boulenger's writing:

Cinosternidae: . . . . The back of the legs of the male in some of the species bear two patches of horny tubercles, and by rubbing these against one another stridulating sounds are produced very similar to those so well known in grasshoppers.

In conclusion it should be understood that this mechanism is peculiar to the males and therefore serves as a dimorphic character.

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333 CENTRAL PARK WEST, NEW YORK CITY.

The Occurrence of Colored Lenses in the Eyes of Snakes and Squirrels, and Their Probable Significance

By GORDON L. WALLS

A YEAR ago, while removing the eyes of a freshly-killed specimen of the European opisthoglyph, *Malpolon monspessulanis* (=*Coelopeltis lacertina*), I accidentally ruptured one, and was surprised to find that the lens was distinctly yellow—about the color of olive oil; only one mention of a normally colored lens, in any vertebrate,[1] is to be found in the literature of comparative opththalmology.

There was of course some doubt as to whether the color was a normal occurrence, for a cataractous lens is often yellow at first. The *Malpolon* lens was crushed, however, and found to be normal in consistency; the coloration was found to be homogeneously distributed throughout the substance of the lens.

Some months elapsed before I was able to secure additional live specimens; two were finally obtained, one of which died during an afternoon or evening soon after arrival. This specimen was discovered, quite rigid, at noon of the next day; the lenses were removed and found to be yellow. They darkened considerably after exposure to air for about half an hour. Since there was still some suspicion that the color was due to pathological or post-mortem changes in these two cases, the remaining snake was killed and a lens immediately removed; it was yellow like those of the other two specimens, thus rendering it quite certain that the color is physiological.

Dr. Harold D. Judd, of Detroit, kindly secured for me some samples of a yellow glass distributed by the American Optical Company; the trade name of this glass is "Noviol," and its various grades have been in favor with riflemen as a spectacle and goggle material. "Noviol" very markedly increases visual acuity; by absorbing the highly refrangible violet end of the spectrum, it greatly reduces the natural chromatic aberration of the eye, thus sharpening vision.

The lenses of both the long-dead and freshly-killed *Malpolon* were

[1] In the European squirrel, Sciurus vulgaris. Merker, E. (1928). Die Sichtbarkeit ultravioletten Lichtes und die Fluoreszenz der Augenlinsen bei Wirbeltieren; eine vergleichende Studie. Zool. Jahrb., Abt. Allg. Zool. u. Physiol., 45: 535-608.

found to be perfectly matched by "Noviol," grade "O"; this glass in turn is matched[2] by 9-L-1 in Maerz and Paul.[3]

Considering the above, it is most significant that Boulenger[4] says of *Malpolon monspessulanis*: "The sense of sight appears to be better developed than in any other European snake." Is it not probable that the acute vision of this species is at least partly due to its "invention" of "Noviol O"?

It was thought that some other diurnal snakes, especially those of racer type, might show a simiiar yellow coloration of the lens; accordingly several species were examined, all of which have round pupils and none of which are nocturnal.[5] The approximate "yellowness" of the lens is expressed by the number after each name, an arbitrary value of 12 being assigned to *Malpolon*:

Malpolon monspessulanis 12; *Coluber constrictor flaviventris* 6; *Masticophis flagellum flavigulare* 6; *Thamnophis sirtalis sirtalis* 6; *Natrix natrix natrix* 4; *Natrix sipedon sipedon* 2; *Drymarchon corais couperi* 1; *Storeria dekayi* 1; *Coronella austriaca austriaca* 1; *Lampropeltis triangulum triangulum* 0; *Micrurus fulvius* 0.

It will be noted that there is a very close correlation between the depth of the yellow coloration and the activeness of the species, those forms which are swift and pursue swift prey having the yellowest lenses. Similarly there is a correlation between the yellowness of the lens and the color pattern of the species, the unicolor and striped forms having yellower lenses than the spotted and banded species (cf. Klauber,[6] pp. 43-46); the unicolor but sluggish *Drymarchon* is the sole exception here.

Snakes with vertical pupils and nocturnal habits would have no need of yellow lenses; in fact such would be actually detrimental to a nocturnal snake since they would decrease the already low intensity of the available illumination. The following nocturnal species, representing several taxonomic categories, were examined; all had perfectly colorless lenses:

Python molurus, Phyllorhynchus decurtatus, Trimorphodon vandenburghi, Tarbophis fallax, Dasypeltis scaber, Bitis arietans, Agkistrodon mokasen and *Sistrurus miliarius*. The author is especially grateful to Mr. L. M. Klauber for permission to remove the eyes from specimens of *Phyllorhynchus* and *Trimorphodon*.

These observations suggest the following generalization, which of course will be fully justified only when a number of additional species have been studied:

Diurnal snakes have yellow lenses, the color being deepest in species which are swift and sharp-sighted, pale or even lacking in the sluggish and secretive species; nocturnal snakes, on the other hand, all have perfectly

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[2] The match was made in daylight by laying the glass sample on the plate of color-samples, so that it covered one half of a given color-sample; a match was considered to have been obtained when the appearance of the covered and uncovered portions of the color-sample was identical.

[3] Maerz, A., and Paul, M. R. (1930). A dictionary of color. New York: McGraw-Hill.

[4] Boulenger, G. A. (1913). The snakes of Europe. London: Methuen.

[5] Several of the forms toward the end of this list have been termed nocturnal. They are undoubtedly secretive and may prowl at night, but are not nocturnal in the sense of being able to see at night, for they have no visual purple in their retinae; consequently they totally lack functional "rods"—the organs of scotopic vision.

[6] Klauber, L. M. (1931). A statistical survey of the snakes of the southern border of California. Bull. Zool. Soc. San Diego, No. 8.

colorless lenses. The yellow coloration, when present, is an adaptation for the improvement of visual acuity; this is effected by the reduction of chromatic aberration in the dioptric media, by the absorption of the highly refrangible violet end of the spectrum.

This situation has a broader significance than may at first appear; the retinal cones of frogs, lizards, turtles, birds, and nonplacental mammals contain brightly-colored oil-droplets whose meaning has been much debated. Yellow drops are always present, green and red ones also occur in many animals. These oil-droplets are absent in snakes (and squirrels); is their place taken by the yellow lens? The writer has not found a yellow lens in any animal which possesses colored oil-droplets; the swift and undoubtedly sharp-sighted *Sceloporus clarki,* also *Crotaphytus collaris, Eumeces fasciatus* and *Chrysemys picta marginata,* among the reptiles, were examined and found to have colorless lenses. Colored oil-droplets are very well developed in diurnal birds, and only colorless lenses were found in the domestic hen and pigeon and in a number of species of song-birds, many of which are insectivorous and presumably sharp-sighted. Like the snakes and the placental mammals, the fishes lack colored oil-droplets; the supposedly keen-sighted rainbow trout, *Salmo gairdnerii,* however, was found not to have the yellow lens that one might possibly expect.

In view of Merker's findings in the European squirrel, a number of local sciurids, representing diverse types, were shot and trapped and examined in fresh condition. Yellow lenses, perfectly matched, like that of *Malpolon,* by "Noviol 0" glass were found in an adult red squirrel, *Sciurus hudsonicus loquax,* in a practically full-grown fox squirrel, *Sciurus niger rufiventer,* and in an immature Lyster chipmunk, *Tamias striatus lysteri.* The lens of an adult striped ground squirrel, *Citellus t. tridecemlineatus,* was found to be appreciably deeper, that of a two-thirds grown grey squirrel, *Sciurus carolinensis leucotis,* decidedly paler than "Noviol 0." These variations are quite in accord with the habits of the various species, as the more deeply colored lenses are found in the forms which expose themselves to the brightest light. The lens of the nocturnal flying squirrel, *Glaucomys volans volans,* was found to be quite colorless, which would of course be predicted from the above theory.

With the exception of the diurnal squirrels, few mammals are diurnal; possibly the hoofed mammals would rank next to the squirrels in visual acuity. Merker found only colorless lenses in domestic Ungulates, and the writer found a colorless lens in the pronghorn, *Antilocapra americana.*

The writer concludes that the snakes, having lost the retinal oil-droplets possessed by their lacertilian ancestors, have been forced to produce a yellow coloration elsewhere in the pathway of the perceived light—in the lens—when, as in swift diurnal species, it became necessary to modify the eye for increased sharpness of vision. In like manner the diurnal squirrels, with great need for sharp vision, have found the same substitute for the oil-droplet mosaic of their remote forbears.

Museum of Zoology, University of Michigan,
Ann Arbor, Michigan.

A Study of Respiration in Hibernating Horned Lizards, *Phrynosoma cornutum*

By George E. Potter and H. Bentley Glass

ALTHOUGH a number of investigations have been made during recent years on the respiratory exchange of different animals in hibernation, so far as the authors know, there have been none on the lizards and the horned lizard in particular. The horned lizard, or horned "toad" as it is commonly called, is very docile and is incapable of inflicting any kind of injury in self-defense. It will remain perfectly quiet for long periods of time without struggling to escape. These characteristics make it a suitable subject for metabolism studies. This animal hibernates, in common with the other animals of its group, by burying itself beneath the sand in late October or early November and making its reappearance late in March or early April in central Texas. It has an interesting method of burying itself, which has been described in detail by Weese. The snout is pushed into the sand with movements from side to side while the body also wriggles from side to side, thus hollowing out the sand until it rolls over the animal. The lizard buries itself under the surface of the sand in this fashion at night during its active period but goes much deeper for hibernation. It can subsist for relatively long periods without food or drink: one specimen which was kept through the period of hibernation and on through the spring with only one feeding and without water except in the last month of its fast, lived until the middle of July before it succumbed.

Conditions of the Experiments

Readings of the respiratory exchanges and determinations of the kilohour production and consumption, respectively, of carbon dioxide and oxygen were made. The series of readings was made upon eight different horned lizards in hibernation, under conditions exactly similar except for the periods of time, which varied from 21.5 to 287.5 hours, and the temperature, which was that of the winter air with the variations shown later in the table. The animals were kept in a box of sand, in which they buried themselves, and were dug up shortly before each experiment, being disturbed as little as possible. All of these animals while in the state of hibernation gave no sign of life other than barely opening the eyes occasionally, and lay perfectly still in the respiratory chamber throughout the course of the experiment. They of course took no food or water.

Methods and Apparatus

The lizards were put in wide mouth glass bottles closed with rubber stoppers with outlet tubes, for the desired period of the experiment. The volume of these bottles varied; most of them ranged between 900 and 1000 cc., but one was used that had a capacity of only 195 cc. The volume

of the air was always computed by subtracting the volume of the animal from the volume of the empty bottle. The temperature and the length of time that the animal was kept in the respiratory chamber were noted for each experiment. There was usually some range of temperature over the longer periods. When the period was up the outlet of the bottle, which had been closed with a pinch clamp, was connected to the intake tube of a Portable Haldane Gas Analysis Apparatus and about 9.5 cc. of the respired air drawn into the burette. This sample was then analyzed for carbon dioxide first by means of a potassium hydroxide solution, and then the oxygen by means of pyrogallic acid dissolved in saturated potassium hydroxide solution. From these percentages the respiratory quotient and the kilo-hour production of carbon dioxide and consumption of oxygen were calculated. (For further description of apparatus, see; Haldane, J. S.: Methods of Air Analysis: 47-53.)

Results

Temp. C.	Wt. Gms.	Vol. of Chamb.	Time Hours	Kilo-hour O_2 c'ns'md	Kilo-hour rate CO_2 pr'd'ced	R.Q.	Condition of Animal
0-10	21.2	923	49.5	8.6714	3.4715	.40041	Semi-coma, early in season
4- 6	21.1	923	24.5	5.1020	2.1789	.42161	Torpor, early in season
7-18	22.8	195	21.5	8.0926	5.7120	.70609	Awake but inactive
0-20[1]	21.7	923	287.5	6.9830	5.0630	.72530	Torpor
9-12	28.0	920	73.5	7.4450	5.9919	.77310	Sluggish
11-12	21.3	195	22.0	7.8373	5.5009	.70105	Awake but inactive
8-12	20.5	915	97.0	7.0783	5.2476	.74087	Sluggish, almost torpor
0-20[1]	21.2	923	456.0	4.3000	3.3000	.72912	Torpor, same animal as first
5-10	28.0	920	22.0	9.2532	5.9934	.64759	Sluggish, semi-coma

It will be seen from an examination of the above table that the respiratory quotients of the horned lizard have some variation, both with the individual and with the length of time for which they have already been exposed to hibernation temperatures. It would of course be supposed that the decreasing oxygen tension as the animal uses this gas, and the increase in the tension of carbon dioxide would affect the respiratory exchange. The data shows that this has been followed out to some extent as seen in the examples that were run for the longer periods, especially in reference to the rate of respiration.

Lest there might be some question regarding any abnormality in the condition of the animals exposed for such long periods as 456 hours in so small a container as about one liter, it might be pointed out that never in the hibernating individuals did the percentage of oxygen fall below 12.5 per cent, while it averaged much more. In experimenting with a series of lizards to determine their hardiness in this respect, a low percentage of 5 per cent was reached at these temperatures before the animals evidenced any signs of discomfort. The highest percentage of carbon dioxide obtained in the hibernating individuals was 6 per cent, while in the check series suffocation was produced only with 12 to 15 per cent.

In other experiments the authors have found that the respiratory quotient for the normal horned lizard when it is not in hibernation ranges from

1 The wide range of temperature is due to the long duration of the experiment.

.6 to .75 at temperatures of 32°-35° C. It has also been found that the normal basic kilo-hour rate of consumption of oxygen ranges between 105 and 168 cc. and the normal rate of production of carbon dioxide ranges between 65 and 100 cc. at temperatures of 32°-35° C. The exact rates are dependent on the size, age, and bodily condition of the animal to some extent and hence the rather wide ranges shown above. It is to be remarked that the respiratory quotients of the hibernating animals are not lower than those of the animals when under average conditions at higher temperatures, except for the first two or three days of the hibernating period, as shown by the first two in the table. The authors have shown by some data to be published elsewhere that there is a definite withholding of carbon dioxide for the first 24 to 72 hours that a horned lizard is suddenly exposed to low temperatures. Following that, the exchange becomes about normal.

The present studies show that the kilo-hour consumption of oxygen and production of carbon dioxide in hibernation are very low, and that as the oxygen tension decreases with time and as simultaneously the carbon dioxide tension increases, the rate for both decreases. The data in the table for the animals that were kept in the respiratory chambers for the longer periods of time bear this out. They show a somewhat lower general rate of oxygen consumption and carbon dioxide production than those that were kept in the chambers for the shorter periods of time. This would seem to show that the animal, at these temperatures, has very little control of the rate of respiration, at least as regards the tension of these gases. But as the tension of the oxygen falls the breathing gets slower. These experiments show the rate of oxygen consumption and carbon dioxide production varying with the temperature. This has been shown in other cold-blooded vertebrates by various workers in this field, notably by Krogh, Vernon, Martin, Lindstedt, Hall and others.

It might be said that there has been found to be a great deal of variation and some irregularity in the rate of respiration and the respiratory quotient of these animals when every one that has been studied is considered. The authors have found some irregularities in certain individuals that have not been accounted for, but they did not seem to be due to experimental error.

Summary

1. The kilo-hour rate of respiration in the hibernating horned lizard is very low when compared with the normal rate, and is quite dependent upon the exact condition of the animal.

2. The kilo-hour consumption of oxygen and production of carbon dioxide vary with the temperature.

3. The respiratory quotients of the animals in hibernation average about the same as those for normal animals at higher temperatures, except for a period immediately following the first exposure to low temperatures.

4. There is some individual variation in the respiratory quotients as well as in the rate of exchange.

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ZOOLOGICAL LABORATORIES, BAYLOR UNIVERSITY, WACO, TEXAS.

Notes on *Batrachoseps*

By BERRY CAMPBELL

THE status of the species of *Batrachoseps* has long been a question to herpetologists. Though several were described as separate species, the value of the taxonomic characters of this group were not clearly understood and many thought that the forms should not have specific standing. Dunn (1926) finally placed all of the forms of the genus under one species, *B. attenuatus*, saying, "There is apparently no overlapping of ranges and the species is one with a number of more or less emphasized local races, and with very indefinite and variable characters."

It has been my opportunity to examine large series of several forms of these salamanders, both alive and as preserved material. I have seen fully 1000 specimens in the field, of which 585 were preserved and entered in my collection. Field work has been done at Berkeley, in Los Angeles County, and on the islands of Santa Rosa and Santa Cruz. Unfortunately there was no opportunity for work in San Diego County, but through the generosity of Mr. L. M. Klauber and the San Diego Society of Natural History, a collection of about 130 specimens has been loaned to me. Topotypes of *B. a. attenuatus, B. a. major, B. a. pacificus,* and *B. a. leucopus* have been observed. The large collections at the Museum of Vertebrate Zoology, California Academy of Sciences, and Stanford University were visited and examined.

In the preparation of this paper, assistance has been rendered by Dr. Loye Miller, Dr. Joseph Grinnell, Mr. L. M. Klauber, Dr. Jean M. Linsdale, and Mr. Joseph R. Slevin, either by the loan of specimens or by suggestions.

In mapping out the ranges of *Batrachoseps* in Los Angeles County, a population was discovered which consisted of both *B. a. attenuatus* and *B. a. major*. No intergradation could be detected, though they were found together; often eight or nine of each species were collected from under the same log or board.

This area, about three city blocks square, was located in South Pasadena on the edge of a rather level territory draining westward into the Arroyo Seco. Bounding it to the south are the Monterey hills, several square miles in area and covered with oaks on the north-facing slopes. In the leaf-mould below these trees, large numbers of *B. a. attenuatus* were found. In the level, drier valley, *B. a. major* is common. It was at the juncture of these two territories that the ranges were observed to overlap. Only this area contained salamanders, the country to the east and west being so unfavorable that neither species was found. Obviously, in southern California, such an overlapping can exist only on protected, north exposures, for on the sunny sides of the mountains, there is always a hot, dry, chaparral belt separating the territories of *B. a. major* and *B. a. attenuatus*. This, at any rate, is the condition at the foot of the San Gabriel Mountains. As *B. a. major* is found only on the coastal drainage, it is improbable that such a mixing of the two species occurs at many stations in the county.

These salamanders are, of course, non-migratory, and it seems perfectly proper to consider the two forms specifically distinct. In 539 specimens from this district in my collection, *B. a. major* may readily be distinguished from *B. a. attenuatus* by (1) the light colored ventrum, (2) the greater size, and (3) by the relatively greater head width. Of these characters, the most trustworthy is that of the ventral coloration. In all of *B. a. attenuatus* examined, the pattern of the dark under surface, as seen through a low-powered microscope, is that of a black reticulum on a light background. This network seems to correspond to the position of the capillaries in the skin. In the case of *B. a. major,* the color of the venter consists of dots not connected to each other to form a reticulum. Laterally these dots join together to form a reticular pattern which underlies the dorsal coloration. The only specimen of *B. a. major* which could not be so distinguished was a young individual only 29 mm. long.

In examining a series of salamanders from Santa Cruz Island, it was found that *B. a. attenuatus* as well as *B. a. pacificus* is to be found there. Five specimens of *B. a. attenuatus* were collected at Scorpion Harbor, May 26, 1929. With them (in the same locality) were collected 22 specimens of *B. a. pacificus*. This fact was discovered too late to determine whether or not there were other specimens of *B. a. attenuatus* wrongly labelled *B. a. pacificus* in the collections examined. Until this can be determined, it seems inadvisable to use the various measurements which

have been published in papers on this form, as they may be of a conglomeration of two forms.

Batrachoseps a. pacificus which I have collected on the islands of Santa Cruz and Santa Barbara resemble *B. a. major* very closely. When specimens of the two forms are mixed, they cannot be told apart with certainty. *B. a. pacificus* seems to have slightly stouter legs and the vomerine teeth are more often in series. In coloration and size, they are nearly identical with *B. a. major.* They are certainly not closely related to *B. a. attenuatus,* which is dark underneath, has small legs, and has a very narrow head.

Bearing in mind (1) that *B. a. major* is specifically distinct from *B. a. attenuatus,* as proven by the fact that their ranges overlap, and (2) that *B. a. pacificus* resembles *B. a. major* so closely that the two forms can not be told apart with much certainty and (3) that *B. a. attenuatus* and *B. a. pacificus* are found on Santa Cruz Island in the same locality, I propose that the classification be revised so that *B. a. pacificus* be separated from *B. a. attenuatus* and that *B. a. major* be included as a subspecies under *B. a. pacificus.*

No specimens of *B. a. catalinae* have been examined, but the description shows it is of the *pacificus* group. This form should be called *B. pacificus catalinae.*

Batrachoseps a. caudatus, on the other hand, is obviously closely related to the typical *B. a. attenuatus.* The name, therefore, stands.

The specimens on hand of *B. a. leucopus* are not sufficient to establish its relationships. Both *attenuatus* and *pacificus* characters can be detected. Though large series from San Diego County, Los Coronados Islands, and the San Pedro Martin Mountains of Lower California were examined, no definite conclusions could be drawn. Those from the Los Coronados Islands and from the city of San Diego resemble to some extent *B. pacificus.* Those from the higher parts of San Diego County and the San Pedro Martin Mountains of Lower California are more like *B. attenuatus.* The intergradation between the two extremes seems very gradual and the question as to whether or not there are two separate forms representing this name can not be answered here.

Summary

1. The ranges of *B. a. attenuatus* and *B. a. major* are found to overlap.
2. *B. a. major* may easily be distinguished from *B. a. attenuatus* by (1) the absence of a ventral black reticulum, (2) by the greater size, and (3) by the relatively greater head width.
3. *B. a. attenuatus* as well as *B. a. pacificus* occurs on Santa Cruz Island. Both have been collected at Scorpion Harbor.
4. *B. a. pacificus* is very closely related to *B. a. major.*
5. Proposal is made that the following classification be adopted:

B. attenuatus attenuatus.	*B. pacificus pacificus.*
B. attenuatus caudatus.	*B. pacificus major.*
B. attenuatus leucopus.	*B. pacificus catalinae.*

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138 N. POPPY ST., MONROVIA, CALIFORNIA.

Records of the Rare Sunfish *Masturus lanceolatus* for Japan and Florida[1]

By Carl L. Hubbs and Leonard Giovannoli

IT has been the privilege of each of us to see a specimen of the little known sunfish or head-fish, *Masturus lanceolatus* (Liénard), one of the rarest of all the larger marine fishes.

The genus *Masturus* Gill (1884: 425), based on *Orthagoriscus oxyuropterus* Bleeker (1873: 151), differs from *Mola* principally in having the caudal fin much wider, and produced medially into a rounded lobe. *Masturus lanceolatus* apparently differs further from *Mola mola* in being somewhat slenderer, approaching *Ranzania* in this respect; in the more anterior location of the eye (nearer tip of snout than gill-opening, instead of in the middle of the head length); in having the dorsal profile of the head more evenly arched, and in the coloration.

The species was described by Liénard (1841: 291, pl. 4) from Mauritius, under the name of *Orthagoriscus lanceolatus*. What is thought to be the same species was described from the East Indies by Bleeker (1873: 151, pl.) under the name of *Orthagoriscus oxyuropterus*. Jordan and Jordan (1922: 88, fig. 7) report an Hawaiian specimen, said by them to be the third on record, and this same specimen was redescribed and refigured by Fowler (1923: 387, and 1928: 474, fig. 80). Schmidt (1921a and 1921b), however, had already recorded the species from the North Atlantic, as had Collett (1896: 163, pl. 6, fig. 1), Streenstrup and Lütken (1898: 54) and others before him.

While in Japan in 1929, the senior author saw a mounted specimen of *Masturus* two or three feet long, having the body and fin proportions as figured for *M. lanceolatus*. It was in a private aquarium-museum-zoo at Fukuoka. Through the kindness of Professor Hiroshi Ohshima we learn that this specimen was found in the fish market of Hagi, Yamaguchi Prefecture, near Shimonoseki, Japan. It was said to have been caught in the Sea of Japan. The exact locality is unknown, but the proprietor of the aquarium thinks that the fish was caught not far out from port. This is, we believe, the first Japanese record for the species.

On April 4, 1931, the junior author examined a huge specimen of *Masturus*, the first adult to be reported for North America. It had been caught on the night of April 2-3 by W. M. Oehler, near Daytona Beach, Florida.[2] It was taken on an outgoing tide in a haul of a 225 foot seine, in a "low water slough" on the beach about 5 miles north of the small town of Ormond. The slough, which was 4 or 5 feet deep at the time, was small enough to be surrounded by the seine.

The sunfish was first sighted after it had been surrounded and was at

[1] This paper was presented at the 1931 meeting of the Society.
[2] We have heard that two other specimens of the same species have been caught recently in the same region.

that time about 50 feet from shore, swimming with its dorsal fin projecting out of the water. It charged the net but the fishermen saw this in time to give it gradually enough slack to prevent its breaking through. It became tangled in the seine and thrashed around mightily, tearing the net but only getting itself more thoroughly trussed up. Mr. Oehler said they used the seine as a hand line to play the fish, giving it line when necessary and hauling it in when they could. They finally got it in water so shallow that it was forced to lie on its side but still gave them some trouble. The outgoing tide helped them to finally strand the fish. They were unable to get the heavy load on their truck, so they left it there and returned the next day. They put ice tongs in its eye and mouth and tried to drag it out but could not make progress except in low gear, so they secured help and finally about a dozen men using timbers, etc., were able to load it.

This Atlantic specimen, which has been mounted for exhibition by a local museum, corresponds well in form of body, fins and head, and in the position of the eye, with the several published figures of *Masturus lanceolatus*. The following measurements were made:

Total length to end of caudal, when fresh, 8 feet and 4 inches; hearsay weight, 1200 pounds; length of head, 19 inches; body thinner than head; thickness of head above eyes, 13 inches; distance from lower margin of eye to line joining middle of mouth with middle of gill opening, 2 inches; length to vertical from anus, 46 inches; vertical height of anal fin, 30 inches; vertical height of caudal fin at middle of main portion (median lobe excluded), 38 inches; length of caudal fin near middle of lower half, 17½ inches; length of caudal fin along midline, to apparently broken and recently healed tip, 26 inches. After the specimen had become somewhat dried out, the following measurements were made: total length 7 feet, 10 inches; length of body, 5 feet, 7 inches; length to vertical from anus, 46 inches; length to origin of pectoral fin, 22 inches; length of pectoral fin, 7 inches; vertical height of body above pectoral base, 19½ inches, and below pectoral base, 16 inches; greatest depth of body exclusive of fins, 38 inches; horizontal length of dorsal fin a little above base, 16½ inches, and of anal, 15½ inches; height of dorsal, 37½, and of anal, 30 inches. Counting rudiments the dorsal rays numbered 18; anal, 17; pectoral, 9. In the caudal fin there were 6 or possibly 7 above, and 9 or perhaps 10 below the median lobe, which appeared to contain no rays.

The middle of the produced caudal lobe was thickened, as though the vertebral column extended into it, but was jointed at its contact with the body, just as were the dorsal and anal fins.

The Florida specimen was a dirty grayish brown, apparently with indistinct irregular spots of the same color in darker shade, on the upper sides. The numerous pale blotches characteristic of the species became most distinct and roundest on the lower half of the caudal fin.

Three circumstances led Collett to the supposition that the sunfishes called *Masturus* might merely be abnormal individuals retaining a larval character. These circumstances are: (1) the extreme rareness of this type; (2) its sporadic appearance, in space and time, and (3) the possession by the postlarvae of *Mola* of a median caudal process suggesting that of

Masturus (see Schmidt, 1921a and 1921b). Other differences, particularly the more anterior position of the eye, indicate however that *Masturus lanceolatus* is really distinct, and Schmidt has proved that this species possesses peculiar postlarval characters, and that the caudal process of the adult *Masturus* is a secondary development which follows the abortion of the primary tail.

Schmidt (1921a: 13) referred to *lanceolatus* postlarval specimens described by different authors, from various localities, including Bahama Banks, Massachusetts Bay and off Pensacola, in North America.

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UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN, and
UNIVERSITY OF FLORIDA, GAINESVILLE, FLORIDA.

Sikukia stejnegeri, a New Genus and Species of Freshwater Cyprinoid Fishes from Siam

By Hugh M. Smith

Sikukia, new genus

DIAGNOSIS.—Form moderately elongate, strongly compressed; head very small; snout entire, very short, blunt, and abruptly decurved; rostral fold covering base of upper lip; mouth small, terminal; lips thin, continuous around corners of mouth, lower lip firmly adherent to sharp-edged lower jaw; postlabial groove interrupted in middle of lower jaw; a small but distinct symphysial tubercle on lower jaw; nostrils placed high on snout, on level with upper border of eye and nearer to eye than to tip of snout; barbels absent; eye large, with narrow annular adipose lid; scales of moderate size; lateral line complete and running in middle of caudal peduncle; a scaly sheath at base of dorsal and anal fins; gill-membranes united to isthmus; gill-rakers rudimentary.

Dorsal short, with 8 branched rays, last simple ray strongly ossified and denticulated posteriorly; dorsal origin over ventral base, its termination well in advance of anal; caudal forked; anal branched rays 6, last simple ray weakly ossified.

Remarks.—In the short, blunt snout, large eye, adipose eyelid, absence of barbels, and denticulated dorsal ray, this genus resembles *Amblyrhynchichthys* in which, however, the mouth is inferior and larger, the upper lip is partly covered by a broad, triangular fold, and the nostrils are at the end of the snout and partly inferior. Resemblance to *Albulichthys* is seen in the terminal mouth, adipose eyelid, serrated last simple dorsal ray, and absence of barbels,[1] but in that genus the mouth is much larger, the maxillary reaches a vertical from the anterior border of the eye, the snout is long and gently arched, the basal half of the caudal is covered with scales, and the gill-rakers are long and numerous.

(*Sikukia,* from the Sikuk River, Siam.)

Sikukia ***stejnegeri***, new species

Description.—Depth 2.8 in standard length, 3.6 in length with caudal fin, 3 times greatest breadth of body; least depth of caudal peduncle about 1.5 in its length and 3 in depth of body; profile from nape to dorsal fin rather strongly arched, a slight concavity at nape, profile of top of head straight, snout abruptly and bluntly curved and very short, slightly more than .5 eye; no barbels; no pores on snout; head 4.2 in standard length;

[1] According to Weber and de Beaufort (The Fishes of the Indo-Australian Archipelago, 3, 1916, p. 106) there are no barbels in **Albulichthys**, and Bleeker, who established the genus, made the same statement. However, all Siamese specimens of **A. albuloides**, the only known species, show small but distinct rostral and maxillary barbels.

mouth terminal, jaws equal, gape less than .25 diameter of eye and less than .5 snout, width of mouth slightly more than .5 diameter of eye; posterior angle of mouth on level with lower edge of pupil; lips thin, lower lip closely adherent to jaw, which has a sharp edge; eye 2.5 in head, slightly less than the strongly convex dorsal interorbital space and slightly more than the ventral interorbital, an adipose eyelid developed mostly anteriorly and posteriorly; gill-rakers numerous but so short as to be practically rudimentary; lateral line gently decurved; scales in lateral series 35, in transverse series 6-1-4½, between lateral line and base of ventral 3, around caudal peduncle 14, between dorsal fin and nape 10; dorsal and anal fins in a scaly sheath.

Fins: Dorsal rays iv,8; last simple ray ossified and posteriorly serrated, its length nearly equal to head; first branched ray longer than head; last ray produced; origin of dorsal rather nearer to end of snout than to base of caudal, slightly posterior to base of ventrals; caudal slender, longer than head, deeply forked, lobes pointed; anal iii,6, entirely posterior to dorsal, small, emarginate, longest ray less than eye plus snout; ventrals not reaching vent, about equal to head less snout; pectorals and ventrals subequal.

Coloration: Silvery, back dark green; dorsal fin with a narrow blackish margin and large black spot anteriorly, involving base of fin as far back as third branched ray; other fins plain.

Type.—A specimen 11.0 cm. long, taken with a cast net in the Sikuk River, Central Siam, November 26, 1923.

Remarks.—This species is as yet known only from the type. It may at once be recognized by the extremely short, blunt snout, small mouth, large eye, and plain coloration with a large black spot at base of anterior dorsal rays.

Named for Dr. Leonhard Stejneger.

Department of Fisheries, Ministry of Lands and Marine,
Bangkok, Siam.

Herpetological Notes

ANOTHER INTRODUCED FROG IN NORTH AMERICA.—Several years ago, on a damp May morning in Key West, after a heavy shower, I heard the unmistakable call of *Hyla septentrionalis*. This sound is like the jerky pulling of a rope through an unoiled pulley and is very characteristic. I hurried on my journey and thought nothing more of the matter until my kind correspondent, Mr. A. G. Elbon, sent me a jar of amphibia taken at Key West but a few days ago. There were, to my surprise, three superb specimens of *Hyla septentrionalis* amongst the lot in the jar. Mr. Loveridge and I compared these carefully with specimens from Cuba and the Bahamas and to my eye they look a bit more like Bahaman than they do like Cuban specimens. I think generally the Cuban frogs have a rather smoother skin than do the others. The probability of introduction from Cuba is vastly greater as not only are there passenger boats plying with Havana daily, but the ferries bring long strings of freight cars back and forth. These often stand for some time on sidings in Key West as they often have been a few days before standing on some woodland siding in Cuba. Moreover they are often loaded with fruit and vegetables.

Mr. Elbon's letter follows. I had asked him what he knew about the occurrence of these frogs.

> I first met with septentrionalis here at Key West about three years ago. That was when I first came here to live. The old people here seem to remember these big frogs in their gutter pipes since they were children. I know of no one here with enough knowledge of natural history to give me any very dependable information.
>
> The only place I have found these frogs is in the pipes leading from the gutters to the cisterns.
>
> Last summer these and the smaller frogs were so numerous as to almost be a pest. I was forced to put a screen over the ends of an eight foot pipe leading from the down spout to a rain water tank and in so doing took twelve frogs from the pipe. Five of which were septentrionalis. This year frogs of all kinds are very scarce. I would call this big frog common here. I have found it feeding almost altogether on the smaller frogs.
>
> Should you desire more specimens I will gladly get them for you.

It only remains to say that it is hard to speculate as to what may turn up next.—THOMAS BARBOUR, *Museum of Comparative Zoology, Cambridge, Massachusetts.*

RANGE EXTENSIONS OF CERTAIN WESTERN SPECIES OF REPTILES AND AMPHIBIANS.—A frog of the genus *Eleutherodactylus* has been received from Mr. Sam Davidson of Fort Worth, Texas. This specimen was collected by Mr. Davidson October 1, 1927, in Madera Canyon, Santa Rita Mountains, Arizona. Miss Doris Cochran, of the United States National Museum, to whom this specimen was sent for examination and comparison, very kindly allowed Dr. Remington Kellogg to examine it, and it was referred by him, on account of the peculiar dorsal spotting, to *Eleutherodactylus augusti*, a Mexican species living in the state of Guanajuato, Mexico, rather than to *Eleutherodactylus latrans*, known only from the state of Texas.

The banded gecko (*Coleonyx variegatus*), hitherto known only from the mainland and from San Marcos and South Santa Inez islands, Gulf of California, has been collected on Cerros Island off the coast of Lower California, where a specimen was taken by the author on June 4, 1925.

Northern records for the state of California are given for the three following species, collected on an expedition to Death Valley in the spring of 1931.

A specimen of *Tantilla eiseni* was taken in Surprise Canyon, Panamint Mountains, Inyo County, May 4. It was captured late in the afternoon while crossing a trail at an elevation of 6,000 feet.

Two specimens of *Phyllorhynchus decurtatus* were taken; one just about midnight while crossing a trail at Mesquite Springs, north end of Death Valley, May 21, and one in the early evening at the mouth of Goler Canyon, Panamint Mountains, Inyo County, May 27.

One specimen of *Trimorphodon vandenburghi* was taken about 9 P. M, while crossing an old abandoned road in the vicinity south of Water Canyon, Argus Mountains, Inyo County, May 6.

A specimen of the Pacific leather-back turtle (*Dermochelys schlegelii*) was

captured between Point Reyes and the Farallon Islands off the coast of Marin County, California, September 7, 1931. This is the northern record for the Pacific Coast, the previous record being that of a specimen taken off the Santa Cruz Light, some eighty miles to the southward. The Scripps Institution of Oceonography reports that owing to the increased warmth of the water off the coast of southern California during the present year tropical fishes have been migrating northward, so this may account for the presence of the giant leather-back at such a high latitude. —JOSEPH R. SLEVIN, *California Academy of Sciences, San Francisco, California.*

AN ADDITION TO THE FAUNA OF LOWER CALIFORNIA.—As *Bufo californicus* (Camp), the arroyo toad, had been taken in San Diego County at Campo, within a mile of the Mexican border, it was assumed that it would be soon forthcoming from Lower California. Now, through the courtesy of Mr. Tony Green, I have received a specimen taken on the Santo Domingo River, above the falls, in the vicinity of San Antonio. This extends the range 130 miles south of the border.

A complete list of the known localities of collection of this toad is as follows:

Ventura County; Santa Paula (type locality).
Los Angeles County; Tujunga Wash, near Sunland.
San Bernardino County; Victorville.
San Diego County; Fallbrook, Pala, 3 miles west of Bonsall, Rincon, Warner's Hot Spring, Lakeside, Dehesa, Descanso, Pine Valley, Skye Valley, Cottonwood, Deerhorn Flat, 3 miles south of Buckman's, Kitchen Creek, Clover Flat, Campo.
Lower California; Santo Domingo River, near San Antonio.

In San Diego County the range seems largely restricted to the sandy washes of the rivers in the Upper Sonoran Zone.—L. M. KLAUBER, *Zoological Society of San Diego, San Diego, California.*

NOTE ON FOOD HABITS OF A RUBBER SNAKE.[1]—There seems to be little known of the food of the rubber snakes or of their methods of obtaining food. The following observation throws some light on both of these matters.

On June 20, 1930, I was encamped, at 4000 feet elevation, on the southwest slope of Cuddy Mountain, Washington County, Idaho. At nine o'clock in the morning I was examining some traps which were set for small mammals. One trap, which had been set on moist ground under a log in a dense stand of Douglas fir, was missing. I peered beneath the log and found the trap three feet from where it had been set. It was holding a live adult white-footed mouse (*Peromyscus maniculatus*) which was caught by the tail only. At the same time I saw a Pacific rubber snake (*Charina bottae*) moving slowly toward the mouse; its head was then about six inches from the mouse. I stepped cautiously over the log in order to obtain a better view, and when I again looked under the log from the other side (about 20 seconds later) the snake was already coiled tightly about the mouse. The mouse's head projected above the coils of the snake which I could see were drawing tighter. By this time the mouse began to gasp for breath and after about three minutes ceased gasping and appeared to be dead. The snake then raised its head and began to move its tongue about over the head of the mouse. This tongue examination lasted a minute or two before the snake commenced swallowing the mouse, head first. The snake loosened its coils slowly as it worked its jaws down over the mouse, but did not straighten out its coils entirely until the body of the mouse had been swallowed. The snake was unable to pull the mouse's tail out of the trap, although it tried so vigorously that it forced its jaws over the corner of the wooden mouse-trap. I then removed snake and trap from beneath the log and placed the two in an open place on the ground. Here the snake continued its efforts to pull the mouse out of the trap. When I released the spring and freed the mouse's tail the snake seemed much relieved, and the mouse soon came to rest in its gullet about six inches from its head.

During the killing, the snake which was seventeen inches long, did not bite the mouse, nor did the mouse attempt to bite the snake. As I observed the process I felt that the mouse was killed by slow suffocation rather than by sudden crushing. This observation also indicates that this gentle, slow-moving snake may move rapidly when capturing certain prey.—ADREY E. BORELL, *Berkeley, California.*

[1] Contribution from the Ralph Ellis, Jr., Collection.

NOTES ON *DERMOCHELYS*.—Recently the Museum of Comparative Zoology acquired, by gift from P. E. P. Dreaniyagala, two late embryos of the unique sea turtle *Dermochelys*. So rare are young specimens of this turtle in museums that it seems of interest to mention these. The embryos were collected in Ceylon, which fact would place them with the Pacific and Indian Ocean form *D. schlegelii* (Garman). Garman (Bull. U. S. Nat. Mus., 25, 1884: 303) gives no description, but refers to the figures in Fauna Japonica (Les Cheloniens, 3, 1838: pl. 1-3) by Temminck and Schlegel. In these figures the chief variation from the Atlantic form *D. coriacea* (Linné) is the relatively greater length of skull of the former. Stejneger (Bull. U. S. Nat. Mus., 58, 1907: 485) includes *D. schlegelii* in his "Herpetology of Japan" but states that the exact status of this form is not known. Taylor (Philippine Turtles, Phil. Journ. Sci., 16, No. 2, 1920: 110-120) also expresses uncertainty. Dr. Malcolm Smith has written me that he is able to recognize but one species of this turtle, *D. coriacea* (Linné).

I have compared the specimens under discussion with the two young of *D. coriacea* in the United States National Museum (Nos. 19796 and 28899, both from Costa Rica) and the young specimen of *D. coriacea* in the Museum of Comparative Zoology (No. 21055, from Guinea, West Africa).[1] Except for a somewhat less symmetrical arrangement of the small head shields and the slightly shorter front flipper length as compared to total length in the Ceylon specimens, I find no clear-cut distinction.

In a recent paper (The Testudinata of Ceylon, Ceylon Jour. Sci., Sect. B., Zoology and Geology, 16 (1), 1930: 43, pl. 7-13) Dreaniyagala has discussed *Dermochelys* at length. He gives descriptions of Ceylon specimens, adult and young, describes food habits, reproduction, oviposition, and has an especially good account of the embryonic stages of development.[2] He recognizes but one species, *D. coriacea* (Linné).

Adults of this species have great powers of locomotion, showing the highest type of testudinate evolution for aquatic life, with torpedo-like shape and perfect streamlining offering easy progress through the water. They range over vast areas. In the Atlantic[3] they are found from Maine and northern Europe to the Cape of Good Hope.[4] Their occurrence in the latter region would indicate that individuals pass from one ocean to the other. The lack of large series of specimens of this turtle, together with individual variations, make the problem of specific differences difficult of solution. I am personally inclined to the view that there is but one valid species of this turtle.—H. L. Babcock, *Boston Society of Natural History, Boston, Massachusetts.*

NOTES ON *PSEUDEMYS STEJNEGERI* SCHMIDT.—Schmidt lays more emphasis on the smaller size of *Pseudemys stejnegeri* as distinguishing it from the Hispaniolan form than on the fact that the axillary seldom reaches the fifth marginal. He gives the length of the largest specimen from Porto Rico as 179 mm., and of the largest Hispaniolan specimen as 241 mm. Three specimens of *P. stejnegeri* in my collection, collected from the Guanica Lagoon (December, 1930), have measurements of 228, 240 and 275 mm. actual length, or of 243, 255 and 300 mm. over the curve of the carapace, respectively. In five specimens in my collection, and in another specimen examined by me, the axillary does not reach the fifth marginal. Thus we have, in Schmidt's material and mine, 3 specimens of *P. stejnegeri* with the axillary reaching the fifth marginal, and 20 specimens in whch the axillary does not reach the fifth marginal. I believe that *P. stejnegeri* is specifically valid, but that size is not a determining character.—Chapman Grant, *Major U. S. Infantry, San Juan, Porto Rico.*

[1] There are also two young specimens of Dermochelys in the British Museum, but both are without locality records. (1929).

[2] He considers Dermochelys to be the result of the first division of the Testudinata, and that as it has always remained in the water, has retained many primitive characters the other turtles lost during their terrestrial periods.

[3] It is interesting to note that up to 1923 only five records of Dermochelys existed along the Pacific coast of the United States, while from the coast of the New England States alone there are at least thirty-five records.

[4] There is a specimen in the South African Museum, Cape Town, taken in Table Bay; and one in the Albany Museum, Grahamstown, South Africa, taken at Port Elizabeth. Mr. John Hewitt of the latter institution, writes that this turtle is "not very rare on our coast."

ADDITIONS TO THE HERPETOLOGICAL FAUNA OF RILEY COUNTY, KANSAS.—The herpetological fauna of Riley County, Kansas, has been listed in two recent papers by Burt (2 and 3) and added to by Gloyd (5). Because of this it seems worth while to record the addition of three species of snakes.

1. *Tantilla nigriceps* Kennicott. Three specimens were found under rocks on a hillside 4½ miles south of Manhattan, Kansas, April 17, 1930. One is in the Museum of the Kansas State College, while the others are in the Museum of Zoology of the University of Michigan. Burt (2) omitted Riley County from the range of this snake in spite of the fact that Branson (1) and Cope (4) recorded it from several counties, including Riley. Taylor (6) also concluded that these records were not based upon "undoubtedly authentical locality data." He therefore records *nigriceps* from Morton County alone, basing the record upon specimens bearing more recent data. Therefore, the rediscovery of this snake in Riley County extends its range northeastward over 300 miles.

2. *Liopeltis vernalis* (Harlan). One specimen, previously incorrectly identified as *Coluber constrictor flaviventris* (Say), is in the Museum of the Kansas State College, and is labeled, Manhattan, Kansas.

3. *Sistrurus catenatus catenatus* (Rafinesque). One specimen, caught at Manhattan, Kansas, is in the Museum of the Kansas State College. Although none has been found recently in this county, the fact that four have been captured only six miles from its eastern line in Pottawotomie County would verify the authenticity of the data on the above specimen.

Thanks are due to Dr. Frank N. Blanchard and Howard K. Gloyd of the University of Michigan for checking the identification of the snakes and to Dr. R. H. Painter of the Kansas State College for advice and criticism of this note.

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(3). Burt, C. E. 1928. A new amphibian record from Kansas. Science, 67: 630-631.
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(5). Gloyd, H. K. 1929. Two additions to the herpetological fauna of Riley County, Kansas. Science, 69: 44.
(6). Taylor, Edward H. 1929. List of reptiles and batrachians of Morton County, Kansas, reporting species new to the state fauna. Univ. Kan. Sci. Bull. 19: 63-65.

HOBART M. SMITH, *Department of Zoology, Kansas State College, Manhattan, Kansas.*

AN EXTENSION OF THE RANGE OF *DICAMPTODON ENSATUS*.—During the process of digging a cess pool for a house in Pullman, Whitman County, Washington, in November, 1930, a live salamander was unearthed and presented to the Charles R. Conner Museum by one of my students. Upon examination, the specimen proved to be a fully adult marbled salamander, *Dicamptodon ensatus*. I have gone over the collecton of amphibians in the Charles R. Conner Museum and have found another specimen of this salamander, heretofore misidentified, from Albion, Washington. This locality is about 10 miles northeast of Pullman. These are the first recorded occurrences of of this species in eastern Washington.

Stejneger and Barbour (1923) and Storer (1925) state that this salamander occurs in North America from central California to the southern coast region of British Columbia. In the state of Washington, it has been known previously from the Puget Sound region (Storer, 1925). The marbled salamander seems to inhabit chiefly the humid costal regions and is only seldom found any distance inland. In California, this species has been recorded from Baird, Shasta County, which is in the north central part of that state. The present Pullman record extends the inland range of the marbled salamander even farther east.

At present (December, 1930) the specimen is alive and thriving in the terrarium of the Charles R. Conner Museum. It is hoped that an extensive search for the species in this vicinity will unearth more specimens and add to our knowledge concerning this salamander.—ARTHUR SVIHLA, *Charles R. Conner Museum, State College of Washington, Pullman, Washington.*

Ichthyological Note

ON THE DIFFERENCE IN THE HABITAT AND THE SIZE OF *CYNOSCION ARENARIUS* AND *C. NOTHUS*.—In COPEIA, (1931, No. 2), Mr. Henry W. Fowler reporting "On a collection of fishes from the Texas coast," records two specimens of *Cynoscion*, having 11 anal rays, under the name of *Cynoscion nothus* (p. 49). These two specimens can not be *Cynoscion nothus;* they are evidently *Cynoscion arenarius*. The differences between these two species has recently been elaborated at some length (Bull. U. S. Bur. Fish., 45, 1929:71-85). If Mr. Fowler will dissect the two specimens, he will find that correlated with the 11 anal rays they also have 25 vertebrae; while *Cynoscion nothus* has 8 or 9 anal rays (infrequently 10 in Atlantic coast specimens only), and correlated with the smaller number of anal rays, it also has 27 vertebrae, rarely 26.

Aside from the radical morphological differences between these two species, as pointed out in the paper cited above, there is also a decided difference in their habitat, although they intermingle to a considerable extent. In the inner bays, sounds and lagoons of the Gulf coast and in the shallower open waters along the shore, *arenarius* is the dominant species and very common, while *nothus* is not common in these locations. The latter species increases in number as the distance from the shore is increased. At some distance from the coast, they evidently occur in approximately equal numbers, as is suggested by the following data. On July 22, 1930, about 10 miles S. E. off Grand Isle, Louisiana, in about 8 fathoms, a haul was made with a 50 foot commercial shrimp trawl, lasting approximately one hour. In addition to a number of miscellaneous fish, chiefly *Micropogon, Trichiurus* and *Larimus*, the trawl brought up 225 specimens of *Cynoscion nothus*, 15 to 22 cm. in total length, the dominant size being 17 cm., and 227 individuals of *Cynoscion arenarius*, 17 to 26 cm. long, the dominant class being 22 cm. Another 40 minute trawl at the same place, yielded 18 of *Cynoscion nothus* and 30 of *Cynoscion arenarius*. Finally, trawling in deeper water, about 30 miles off Grand Isle yielded a few small specimens of *nothus*, 39 to 58 mm. long, but no *arenarius* were taken. While these data are, of course, not extensive enough to be conclusive, they represent our present knowledge regarding the relative abundance and habitat of the two species, and possibly justify the general statement that *arenarius* is more of a shallow water form, while *nothus* occurs more in deeper water, but the two occur together at comparatively intermediate depths.

There is also a marked difference in the size attained by the two species. This is well shown in the dominant size classes as well as in the extremes, as recorded above for the one haul. General observations made in the field also bear out this conclusion. Specimens of *nothus* more than 10 inches in total length are not common, while examples of *arenarius* about a foot in length are frequently encountered. An examination of the commercial catch added further proof of the difference in relative size. These fishes are used for food to a limited extent on the Gulf coast. In Louisiana, Mississippi, and Alabama, they are collectively known as "white trout" while in Texas they are called "sand trout." The fishermen are unable to distinguish the two species. On Grand Isle, on one of the "shrimp platforms," during the summer time and the closed season for shrimp, the white trout is prepared for the Chinese trade by salting, followed by sun drying. Fish of about a foot or over in total length are used, since it does not pay to handle the smaller fish. One day on a visit to this platform, trays of salted white trout were drying in the sun. I walked along the trays and examined carefully individual fish, and not a single specimen of *nothus* was encountered. This species evidently does not often reach commercial size, at least on the Gulf coast. At any rate, large specimens are not taken where the fishermen usually are in the habit of taking "white trout." Whether larger specimens are found in deeper water is unknown at present.—ISAAC GINSBURG, *U. S. Bureau of Fisheries, Washington, D. C.*

REVIEWS AND COMMENTS

THE BIOLOGY OF THE AMPHIBIA. By G. Kingsley Noble. McGraw-Hill Book Company, New York, 1931, xiii+577 pp., $5.00.—Herpetologists have not for a long time had so useful a book as this come to their hands. It appeals, moreover, to a much wider circle of zoologists: vertebrate anatomists, experimental zoologists, and teachers of general zoology will find it an indispensible reference for an authoritative and modern treatment of any subject relating to the Amphibia.

The major portion of the book, 458 pages, is given to structure and functions, and the remainder, 87 pages, to relationships and classification. Relationships are, however, mentioned or discussed at innumerable points in the first part of the book. Ten chapters, nearly half of the whole book, are devoted to structure and physiology, under such headings as The Integument, The Respiratory System, The Circulatory System, The Endocrine Glands, The Sense Organs and Their Functions, and The Nervous System. The remaining chapters in the first part deal with the Origin of the Amphibia, Development and Heredity, The Mode of Life History, Speciation and Adaptation, Sex and Secondary Sex Characters, Instinct and Intelligence, The Ways of Amphibia, The Relation of Amphibia to Their Environment, and Geographic Distribution and Economic Value. The limitations of space will be keenly felt in the treatment of many of these topics, but the only remedy would too greatly increase the size of the book.

Since the literature has evidently been thoroughly searched the bibliography is a most important feature. Its use has been facilitated by listing the references to each topic at the ends of the chapters, instead of assembling them in one long list at the end. The book is generously illustrated and the index is unusually full. The whole make-up and typography are in the excellent and substantial style for which McGraw-Hill publications are noted. Errors are uncommonly few for a first edition, and although some authors will feel that their results have been misinterpreted and that judgments on controversial topics are sometimes too positive, the difficulty of covering so great a quantity of literature to general satisfaction will be adequate excuse.

Dr. Noble is to be congratulated upon the production of so valuable and excellent a piece of work,—a work that no one else in the world is so well qualified to undertake.—FRANK N. BLANCHARD, *University of Michigan, Ann Arbor, Michigan.*

ILLUSTRATIONS OF JAPANESE AQUATIC PLANTS AND ANIMALS. Volume 1. Fisheries Society of Japan (Dai-Nihon Suisan-kwai). Tokyo, 1931, 50 large colored plates with explanatory text in Japanese and English, preface, table of contents and index.—This magnificent volume, the envy, yes, and despair of those of us who plan to illustrate our own aquatic organisms, will portray in two volumes more than 700 aquatic animals and plants of Japan. The figures are reproduced from paintings by the famous fish artist Kumatarô Itô, which are remarkably true in drawing and coloring. The Supervisory Committee on Compilation is composed of Chiyomatsu Ishikawa, grand old man of Japanese zoology, Kintarô Okamura, Shigeho Tanaka, Arata Terao, Hisatoshi Marukawa, Tadashi Higurashi, Hidemi Senô and Ken-ichi Ebina. This list of notables assures the high quality of the work. The text accompanying the plates gives for each species the scientific and vernacular name, a terse diagnosis, and distributional and natural history notes. The first editions of this work, in Japanese only, were published in atlas form in 1892, 1900 and 1910. The current work, a new production, issued to commemorate the fifteenth year since the Fisheries Society of Japan was founded, is much enlarged and improved, and is made available to foreign workers by having the text repeated in English. Fortunate indeed are eleven American institutions which receive complimentary copies of this truly magnificent work, through Ichijirô Itani, President of the Fisheries Society of Japan.—CARL L. HUBBS, *Museum of Zoology, University of Michigan, Ann Arbor, Michigan.*

EDITORIAL NOTES AND NEWS

A Tribute to Leonhard Stejneger

TO the members and others who have contributed so generously toward the preparation of this small tribute to our beloved Dean of American Herpetology, the Society is deeply grateful.

The Death of David Starr Jordan

OUR joy in honoring Leonhard Stejneger is saddened by the news of the death on September 19 of David Starr Jordan, whom we similarly remembered at the close of last year. Among multitudes of others, the ichthyologists of America, few of whom do not owe their training directly or indirectly to this master, keenly feel the loss which none can fill. But well may we all resolve to redouble our efforts toward the solution of the many unsolved problems which confront us, and thus to carry on and keep alive his work.

The Cruise of the Yacht Alva

WE learned from *Science* that Mr. William K. Vanderbilt's yacht "Alva," left Long Island, on June 7, for a voyage of exploration around the world during which specimens of marine life will be collected. Special equipment has been installed on the Alva for collecting and preserving the marine specimens which will be brought to the Vanderbilt Marine Museum at Centerport, where specimens gathered during the past twenty-five years are to be found. The trip of the Alva, which will take several months, will include the Panama Canal, Galapagos Islands, the Society Islands, Samoa Islands, the Fijis, New Hebrides, New Caledonia, Australia, the south coast of New Guinea, the islands of Flores, Java, Sumatra, Singapore, Burma, Ceylon, the Red Sea, the Mediterranean and then home by the Canaries and the Windward Islands.

American Fisheries Society

THE American Fisheries Society met at Hot Springs, Arkansas, on September 21 to 23. The meeting was very successful, especially on account of the lively discussions of fish and fishery problems. As usual there were presented a series of valuable papers, based on both research and practical experience, and covering the fields of fish culture, nutrition, diseases, etc. The announcement of a really successful fishway was a feature. Of special interest to ichthyologists was a series of papers dealing with the status, ecology and propagation of the newly recognized Kentucky or spotted bass, *Micropterus pseudaplites*.

News Items

HENRY O'MALLEY, U. S. Commissioner of Fisheries, during the summer led a party of federal officials and congressmen to Alaska, to inspect the fishery resources and their federal administration.

Dr. William M. Mann, director of the National Zoological Park has spent the latter part of the summer in the Guianas, obtaining specimens for the zoo.

Dr. G. Kingsley Noble of the American Museum spent the summer teaching comparative anatomy and experimental biology at the University of Chicago.